THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXXVIII. No. 10. Whole No. 574. | NEW YORK, WEDNESDAY, MAY 16, 1883. | $3 PER ANNUM IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
G. WARREN DRENNER, C.E., Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $3.50 (15 shilling—18 francs). All payments to be made in advance. Single copies, 15 cents.

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[OFFICIAL NOTICE.]

Fifth Annual Meeting of the Central New York Gas Engineers Association.

The fifth annual meeting of the Central New York Gas Engineers' Association will be held at the St. James Hotel, Bradford, Pa., on Wednesday, May 23, at three o'clock P. M. It is earnestly requested that every member will be in attendance, and use every endeavor to make the meeting a profitable one. Please notify the President at Hornellsville, N. Y., by May 10, whether or not you will be in attendance.

C. A. WHITE, Secretary. J. MCDOUGALL, President.

THE CINCINNATI MEETING OF THE WESTERN GAS ASSOCIATION.

The meeting of the Western Gas Association, held at the Burnet House, Cincinnati, Ohio, on May 9, 10 and 11, fully justified the expectations which had been entertained. The interest in the meeting was general and sustained; there were 93 members in attendance at the sessions; 49 new names were added to the roll; nine papers, on subjects of interest to every "gas man" in the country, were read. The officers elected were the following:

President—J. B. Howard, of Dubuque, Iowa.

Vice-Presidents—T. G. Lansden, of St. Louis, Mo., and James Somerville, of Indianapolis, Ind.

Secretary and Treasurer—A. W. Littleton, of Quincy, Ills.

The proceedings of the first day, up to and including the President's address, will be found on page 224 of this issue. The meeting will be reviewed in detail in our next.

THE COMPARATIVE VALUE OF DIFFERENT GRADES OF RETORTS.

The remark was made at the last meeting of the New England Association of Gas Engineers that if, as a standard of comparison, the cost of a good retort is placed at $20, and its length of life assumed to be 15 months, its comparative value will be $29.17 if it can be made to do good service for three months longer; and, in the reverse direction, if a retort expires at the early age of 9 months, its comparative worth will be represented by $14.66, having before it a minus sign.

We would not be so rash as to assert that many of our readers think there is any economy in using poor retorts; but if there be any such they must needs find it difficult to maintain their ground in face of Mr. Yorke's pointed calculation cited above.

We do not, however, intend to follow the gentleman any further in his remarks on this score, preferring to pursue the investigation on independent lines, simply pausing to thank Mr. Yorke for having turned our thoughts in the direction indicated.

With these desultory remarks, standing by way of preface, let us proceed with the discussion of our theme—namely, the comparative value of different grades of retorts.

The question first arises, as the efficiency of a retort is so dependent on the quality of the tiling and other fire stock employed in the erection of a bench, and the skill displayed by the mechanic in erecting the work, is it possible to assume, with any degree of certainty, that one retort is worth $5 or $6 less than another sample? Let us put this contention more clearly: suppose a retort breaks down, on account of settling of the bench, at the end of 12 months; would it be just to assert that such a retort was of poor quality? For any ordinary case, we would claim the deduction to be a fair one; an exceptional instance would be where, the house being erected on made ground, the benches have settled 10 or 11 inches. This would be a severe strain on any retort, good, bad, or indifferent; nevertheless, even under such untoward circumstances, a well made retort would stand the test better than one, of inferior make. Manifestly, then, it would be far more just, in any ordinary case, to figure on the presumption that the value of a retort is in proportion to the amount of its work.

We would not have it inferred from these remarks that we underestimate the importance of good fire bricks and skillful labor, because we fully appreciate the value of these two factors; but a shrinkage of the fire stock and joints is one of the exigencies a retort has to stand; and the manner in which it passes through the ordeal indicates its value.

This plan of estimating the value of a retort on a basis of the work it performs is apparently open to a second stricture; for it may, with a show of reason, be claimed that the quantity of gas one of these carbonizing vessels will make will be greatly influenced by the heat at which it is run. If we were to adopt the too common method of expressing the life of a retort—that is, the number of months it is in service—this objection would have considerable weight; as, however, we intend to disregard the length of service of a retort, and speak merely of the quantity of gas it will make, this second objection will disappear, because, when the heat is high, a greater amount of gas will be made per retort in each day; so, though the length of its service may be shortened, the quantity of gas produced will not be diminished.

This point will be the more readily acquiesced in when it is remembered that whereas in England, where what we call low heats are in vogue, the life of a retort is usually estimated at 2 to 2½ years, making during that time about three million feet, we in this country get about the same quantity of gas out of a retort, but do so in from 18 to 20 months.

Thirdly, the claim may be advanced that the efficiency of each of these members of the carbonizing plant will be materially affected by the number of times the bench of which it forms a part has been cooled down and reheated. If, for the sake of argument, we admit it does harm a setting to let it run down and refire it, we must contend it does not necessarily follow that the fact vitiates the plan of estimating the value of a retort by the work it does.

In a word, then, the use of some inferior fire bricks, the employment of more or less unskillful labor, and occasional cooling down and reheating, are among the adverse occurrences in the life of a retort, and a good one will pass through these trials better than an inferior one. It therefore follows that the amount of gas a retort will make is, on an average, a fair criterion of its inherent value.

This being the case, it now remains for us to establish some equitable basis by which the different grades of retorts can be intelligently compared. With this object in view, we may assume the cost of any ordinary retort to be $20 at the factory, and its life 2,750,000 cubic feet. We may further take it for granted that the cost of resetting a bench of fives will be $400, itemized as follows:

	For Bench.	For each Retort.
Retorts	$100	$20
Labor	135	27
Tiles, etc	110	22
Freightage	45	9
Sundries	10	2
	$400	$80

As the total cost will vary somewhat according to the number of benches being reset at one time, we will reduce the figures in the final column to the percentages of the footing of that column; thus—

	Percentage of Cost. Total cost of resetting each retort = 100.
Retort	25 per cent.
Labor	34 "
Tiles	28 "
Freightage	11 "
Sundries	2 "
	100 per cent.

It therefore follows that, as the cost of the retort itself is only one-quarter of the amount to its debit when set complete, it will be the part of true economy to put a few extra dollars into the first cost of one of these vessels, if by so doing we will get a better article. Let us show this by a series of figures: We have assumed the life of a retort to be 2,750,000 cubic feet; this will give as the cost for bench work, per million feet of gas made, $29.09. If, however, by putting an extra dollar into the cost of the retort we increase its life by 10 per cent., or 275,000 feet, the expense per million feet will be reduced to $26.77; or if for $22 we can get a retort which will make 3,300,000 feet, the figure will drop to $24.84. In the reverse direction, if, in the attempt to be economical, an $18 retort be purchased, and it make only 2,200,000 feet of gas, the expense per million feet will be $35.45.

We may put the same results in a slightly different shape—thus: If the normal cost of a retort be placed as before at $20, its life 2,750,000, feet, and if its service be increased by 20 per cent. its value will be enhanced in the same proportion figured on the basis of its cost when erected—that is, 10 per cent. of $80 = $8, making the value of the retort $28. Were its life prolonged by 20 per cent., its value would be $36. And, in the reverse direction, if its capability were only 2,200,000, it would be worth but $4; continuing in the downward scale, were the retort to give out after having produced only 1,650,000 feet, its value would be represented by $12 with the minus sign prefixed.

As the value of each of the factors which entered into the above calculations will vary for different localities, the result will only be of limited application. We would therefore offer the following formula, by the aid of which a manager can ascertain the value of any retort compared with ones he has used. Thus—

$$\frac{(d - c) \times 100 \times b}{c} + a = v.$$

in which a = cost of k, in dollars.
b = total cost of retort k when set, in dollars.
c = life of k, in cubic feet.
d = life of l, in cubic feet.
k = retort used as standard for calculation.
l = retort whose value is sought.
v = value of l, in dollars and cents.

To apply the above formula, let us suppose a manager is using retorts costing him $18 at the factory and $78 when set complete, and he is making 2,600,000 feet per mouthpiece. We will further presume he is offered an article of a higher grade for $22, and is assured from the record of the retort in other works that this will produce 3,200,000 feet. By resorting to the formula given above he will be able to ascertain whether or not it will be to his advantage to accept the more expensive article; thus—

$$\frac{(3{,}200{,}000 - 2{,}600{,}000)\ 100 \times \$78}{2{,}600{,}000} + \$18 = v = \$35.94.$$

If it be desired to ascertain the comparative value of a lower grade retort than the one used as the standard for comparison, then the formula will stand—

$$a - \frac{c - d \times 100 \times b}{c} = v.$$

It is to be noted that in the foregoing we have been speaking merely of different grades of retorts, presuming the size of each one of the different classes to be the same. It would be interesting to investigate, by a similar process of reasoning, the financial results ensuing from the use of different sized retorts. The calculation would, however, be of a more complex nature; but we may revert to it on a future occasion.

THE CENTRAL NEW YORK MEETING.

The annual meeting of the Central New York Gas Engineers' Association will take place at Bradford, Pa., on Wednesday, May 23. The present prospects are that the meeting will be one of more than ordinary value and interest to the fraternity of New York and New England. The place at which the meeting is to be held possesses a great number of interesting features, being as it is the center of the greatest oil-bearing territory in the United States, and also the "home" of the natural gas well. Ex-President Wood, of Syracuse, has issued an invitation to those intending to be present at the Bradford meeting to stop over at Syracuse and pay him a visit. Syracuse itself bristles with much that is worth seeing, and those who have never inspected the great salt works will feel well repaid should they seize this opportunity to so do. Besides, Brother Wood's works are well worth seeing, as also are the Solvay Chemical Works, now in process of construction, in which it is proposed to work up most of the ammoniacal liquor made in this country. We would say to every gas man who can possibly make it convenient, by all means attend the Bradford meeting of the Central New York Association.

Mr. Helme Scores a Victory at Atlanta, Ga.

At the meeting of the Board of Council of Atlanta, Ga., held Monday, May 7, the matter of granting the petition asked for by a concern calling itself the Gate City Gas Light Company, to lay mains in the streets of the above-named city for the purpose of supplying gas, was considered. The Atlanta Gas Light Company, at the time of its inception, obtained from the city authorities the exclusive right to supply gas in Atlanta for a period of fifty years. During the unsettled state of affairs in the South, in the period embraced between the years 1861 and 1868, the Atlanta Gas Light Company suffered in common with every other Southern interest; but, now that prosperity reigns supreme, the attention of the "wreckers" was attracted to what seemed a favorable opening for their peculiar faculties. At the meeting of the Council alluded to above, Mr. Helme, of Philadelphia, and Col. Glenn, both gentlemen being largely interested in the old Atlanta company, succeeded in convincing the Councilmen that the best interests of the city would be most thoroughly served by keeping inviolate the contract now existing; and so the "gate" was not opened to the plunderers. We shall publish the history of the grab in our next issue.

The Management of Small Gas Works.

By C. J. Russell Humphreys.

[Continued from page 220.]

To facilitate firing with hot coke we will use a sheet iron shute 6 ft. wide and 2½ ft. in length, the sides being made on an incline, so that the coke, as it drops thereon from the retort, will fall to the center, whence it can be quickly pushed into the furnace. The center of the shute will project through the doorway about 6 inches, and will be supported on a pair of wheels, so that it can be conveniently handled. The portion of the coke not required for the fires will drop to the lower floor. When only one man is employed the coke may be partially quenched by throwing a pail of water on it from the working floor; after the charge is completed, the man will be free to thoroughly extinguish it and shovel it out of the way, if necessary. In ground floor retort houses it is well to draw the coke into a wagon, and after throwing a pail of water on it, wheel it to the coke shed; this obviates the cooling effect on the bench which is produced when the coke is drawn on to the floor, and then slacked. It, however, sometimes happens that the incline of the floor from the face of the setting is so steep as to preclude the use of coke wagons. In such a case we can but make the best of circumstances and draw the coke on the floor.

We think it decidedly beneficial to charge but half a bench at one time, as the demand on the heat of the setting is thus more nearly equalized; but in a small works, where the retort house men have other duties to perform, this is not always practicable, as it cuts up the day too much. We will therefore compromise the matter by charging two retorts at a time, and allowing twenty minutes to intervene before commencing to draw another pair.

It is impossible to say too much relative to the care of the furnace fires, for on the proper performance of this work depends in a great measure the success of the concern. This remark may seem too sweeping, but we think it perfectly sound, because if the fire is injudiciously managed loss will ensue both as regards the quantity and quality of the gas, and the residuary coke. One point which should be constantly borne in mind is that the greatest supply of heat is required during the first two hours of the charge, and that therefore the time for firing should be so chosen as to ensure a good fire during this period. When hot coke is used in the furnace, this matter, to a certain extent, regulates itself, and a hot fire is ensured when required; but when cold fuel is used, it becomes necessary to insist on a good fire being *made* up half an hour before charging time. If the furnace door is opened and cold coke put in while the gas is being rapidly evolved, the heat will drop before the furnace can begin to do efficient work, the result being a loss in gas but a gain in tar.

The same remark applies to the time for clinkering; this should be done before making up the fire at the end of the charge; it will be better to do it at this time rather than when firing the second time, two and a-half hours later.

Another point worthy of comment is the position of the furnace bars. It is by no means a rare thing to have these end inside the door so that they can not be reached without opening the latter. This is very objectionable. The bars should pass under the door framing and project beyond it 3 inches; by this arrangement the bars can be shaken without allowing cold air to pass into the setting.

Tar, as fuel, is a valuable adjunct to the coke fire, preventing in part the falling of the heat when a new fire is put in. The quantity of tar to be used must be regulated by local circumstances; thus, if this residual is a drug, it will be policy to use it all in the furnace and save the coke. In small works, where only one bench is run, even if all the tar is burnt, it will still be necessary to use some coke with it; but in large factories it is usual to run every third bench with this fuel alone, in which case the door is kept shut, and the ash-pan almost entirely closed, the air for combustion being drawn in with the fuel. A cheap style of tar burner consists of a piece of 1¼ in. pipe 10 inches long, having a ⅜ inch pipe passing through it. The tar is fed through the latter, while the steam comes in through the larger pipe. At the furnace end of the burner is a 1¼ × ⅜ inch reducer. Both pipes are screwed into this fitting. In the outer circumference of the smaller tube, where it passes into the above coupling, are cut four longitudinal grooves about half the depth of the metal; through these the steam passes blowing the tar into the furnace. If steam is not to be had, the tar may be allowed to drop on an inclined tile inserted in the front wall of the setting just above the furnace door frame. a little water being allowed to drop in with the tar. The tar should be fed from a small overhead tank, placed between the end of the stack and the retort house wall. Such a tank can be made of No. 14 sheet iron, riveted to 2½ inch angle iron. As, however, it will be exposed to considerable heat, it will not be advisable to use red lead cement for the joints, as it would quickly boil out. The following cement will be found efficient for such a purpose. Ten parts by weight of white lead, 3 parts manganese black oxide, 1 part litharge, ½ part dry red lead.

If steam be used in conjunction with tar, it will be necessary to protect the steam pipe, from the boiler to the burner, so that the latter will be supplied with dry steam. A good plan is to carry the pipe up over the flues; or, if this plan is not adopted, the pipe should be carried along at the back of the bench against the flues and buried in the soot which always collects on the top of the stack. In either case the pipe, from the boiler till it reaches the stack, should be covered with non-conducting material. A very good way of doing this is to box the conduit in, leaving a space of 2 inches all around to be filled in with the dust from the top of the benches.

A gallon of tar as fuel may be reckoned equal to half a bushel of coke, so that the tar at 4 cents a gallon is equal to coke at 8 cents a bushel. It is further to be remarked in regard to this liquid fuel, that it is possible to keep up the heats with it when it would be difficult to do so with coke alone, particularly where there is a poor draught.

Another important matter connected with the care of the fires is the damper. First, as to their position. In this country, where short chimneys, four feet in height, are in use, it is customary to employ as a damper a tile, placed on top of the stack; and this being a very unhandy situation, it is apt to remain in one position for a long time. There is another objection to this disposition of that useful appendage of a setting, for the damper is the division wall, so to speak, between the heat of the setting and the outside atmosphere; then why place it as far as possible from the fire? Our opinion is that it is all wrong to have the damper on the top of the stack, and that its proper position, for a single bench, is just above where the horizontal flue runs into the chimney. As before remarked, it is the damper which restrains the heated product of combustion in the bench, so that in the common arrangement the chimney is kept intensely hot and is constantly radiating the heat into space. By the plan we have chosen, this waste will be greatly lessened, besides which, having a 6 feet space at the back of the benches, the damper can be easily regulated.

This brings us to the second division of our subject—the care of the dampers. In order that the importance of this matter may be fully realized, let us examine briefly into the theory governing the heating of retorts by a common furnace, premising our remarks by reminding the reader that a heating medium must be of greater intensity that the object to be heated. Thus, if the products of combustion from the coke were of a lower intensity than the retorts, heat would flow from the latter to the former, so cooling the retorts. The point, therefore, to be aimed at is to admit to the setting sufficient air to convert the carbon to carbonic acid, but no more. Of course this is a condition we cannot attain to in practice, but we must reach as near to it as possible. Certainly we cannot emphasize this remark better than by giving examples of the effect produced by burning coke with different proportions of air. We may assume that the fuel named will require for its complete combustion 12 pounds, or 150 cubic feet of air, and we will place the heat units of coke at 14,500. One pound of coke will therefore unite with 2.67 pounds of oxygen, producing 3.67 pounds of carbonic acid and setting free 9.33 pounds of nitrogen. Hence—

	Pounds.	Specific heat.		Heat units.
Carbonic acid.....	3.67.	.2164	=	.794
Nitrogen.....	9.33.	.2440	=	2.276
	13			3.070

the number of heat units absorbed in elevating the temperature of the products of combustion of one pound of coke one degree F. By dividing the total heat of combustion of the coke by the figure just arrived at, thus, $\frac{14500}{3.070}$ = 4,723° F., we have the highest theoretical temperature attainable by the perfect combustion of one pound of coke. If, however, we were to admit into the furnace 18 pounds of air per pound of coke, the temperature of the products would be about 3200° F.; while if 24 pounds of air were used in place of 12, the figure would drop to 2,400° F.

With these considerations in mind, let us return to the matter now in hand—the regulation of the dampers. These tiles being fixed for the proper combustion of a given quantity of coke, it is clear from what has been said that if we make a change in the quantity of fuel burned, we must readjust the dampers. As an illustration, let us take a bench of five retorts carbonizing 7,500 pounds of coal in 24 hours, using in the furnace 50 bushels (or 1,875 pounds) of coke. In the common style of furnaces we will have to admit air at the rate of 24 pounds per pound of fuel, or 45,000 pounds per day. This will give, as the intensity of the products of combustion, 2,400° F. Now, let us suppose on an "off day," when the holders are full, that we carbonize only 5,250 pounds of coal—a by no means uncommon occurrence in a small works. The firemen will naturally cut down the quantity of coke used in the furnace, perhaps to the extent of 10 bushels. If, then, the dampers are not partially closed, what will the result be? Simply that 30 pounds of air are passing into the furnace for every pound of coke used. By calculation we find the intensity of the products of combustion, under these circumstances, to be 2000° F. We may then anticipate a dropping off of the heat of the bench. Possibly, however, the stoker will perceive that the benches are

cooling and will, by hard firing, regain the lost ground; but, if so, it will only be by the use of a large quantity of fuel—whereas, had the draught been properly regulated, the heat could have been easily maintained by burning the 40 bushels of fuel. Has it not come under the notice of some of our readers that on Sundays or other days when full charges were not run, it was found that the yield had fallen off, when, owing to the light charges employed, it would be expected that the converse would hold? May not this apparent anomaly be explained by the illustrative case cited above? We think it can. This, however, is but one example of the importance of regulating the dampers. The subject might be greatly enlarged upon.

As another example: If the heats are down, and it is attempted to burn more coke without opening the dampers, a large quantity of carbonic oxide will be formed. In a word, then, the draught must be intelligently regulated according to the varying conditions of the fire.

[To be continued.]

A Hygienic Comparison Between the Light of Electricity and that of Coal Gas.

By B. H. Thwaite, C.E., F.C.S.L.

Some years ago I drew attention, in the columns of a contemporary, to the fact that, although the carbon points of the electric arc light were rendered incandescent purely by the phenomenon of frictional resistance to the passage of electrical currents, and therefore not in the least dependent on the chemical action of oxidation, yet the intense heat of the voltaic arc would produce a rearrangement of the gaseous constituents of the atmosphere, from a combination mechanical to one chemical, with the resultant formation of the deleterious nitrogen oxides. The correctness of my opinion was subsequently confirmed independently by Mr. Wills, F. C. S. A glass cylinder placed over an electric lamp (Foucault's regulator) for two minutes, and afterwards examined, was seen to contain a perceptible quantity of red fumes, due to nitrogen peroxide (N_2O_4). The air surrounding the lamp was next drawn through a solution of potash, and the amount of nitric acid estimated; and it was found to produce from 10 to 12 grains of nitric acid (N_2O_5) per hour. Therefore, unless the electric lamps (of the arc type) are enclosed in air-tight globes, they can hardly be considered to be perfectly hygienic. The remarkable results of the application by Dr. Siemens of the arc light for the developments of plants will no doubt be well-known to the reader; but experiments in the same direction, conducted by M. P. P. Deherain at the Palais de l'Industrie, Paris, in 1881, only had very partially successful results. Indeed, the results of the experiments with the naked arc light may be considered in the light of a failure. M. Deherain states (see *Annales agronomiques*, pp. 551-575) that at the end of seven days the naked arc light was seen to have an injurious effect both on those plants which were constantly subjected to it, and in a less degree on those which were exposed to it during the night only. The leaves blackened, withered, and dropped off. The injury, however, was confined to the epidermal layers, and was due to the direct impact of the luminous radiations, and not to the nitrogen oxides; for where one leaf was partly shaded by another, a sharp line was photographically impressed. Even in the experiments with the arc lights protected by globes of colorless glass, the results were not much more satisfactory. Seedlings exposed exclusively to the electric light perished sooner or later, and the leaves of some of them were blackened as with the naked light. Mature plants, on the other hand, continued to vegetate; but in no instance, except in that of a plant of barley, were flowers and seeds produced, the vegetation being merely foliaceous. M. Deherain's conclusions are as follows:

1. The electric arc lights emits radiations which are injurious to vegetation.
2. Most of these radiations are arrested by colorless glass.
3. The electric light emits radiations powerful enough to maintain mature plants in vegetation for two months and a half.
4. The beneficial radiations are not sufficiently powerful to cause the growth of germinating seeds, or to allow of the maturation of fruit in older plants.

The heat developed by the resistance of the minute filament of carbon, as arranged in the incandescent lamps of Swan and Edison, would not, of course, produce any rearrangement of the gases constituting the atmosphere; and even if it did, as the filament of carbon is fixed in *vacuo*, there could be no possible vitiation of the atmosphere. Hence *per se* the electric light of the incandescent type is hygienically satisfactory; but neither the incandescent nor the arc electric light assists ventilation. Besides the nitrogen oxides produced by the arc light, probably as much carbon dioxide is produced, in amount, for the same illuminating power as is produced by the combustion of coal gas. In both descriptions of artificial light the luminosity proceeds from the same cause—namely, carbon in an atomic or solid state heated to incandescence. The electric light produced by incandescent lamps is in almost perfect accordance with the laws of visual or ocular hygiene; allowing, as it does, various colors to be distinctly chosen as in solar light. The arc light, however, is not so satisfactory. The varying light-densities, caused by the use of heterogenous carbons, produce ocular muscular fatigue, besides rendering the retinal image very indistinct. It is generally conceded that the nearer a system of artificial illumination approaches in resemblance to that of the mean intensity of diffused sunlight, the more perfectly is the system adapted to the human organs of vision. The degree of the density of an illuminant can be judged with approximate accuracy by the degree of darkness of its shadow; and, judging from this standard, the naked arc light is too intense, at least for domestic and workshop purposes, as the shadows it produces are considerably darker than those of the light from the unclouded noonday sun. But, of course, the density of the light can be reduced to any degree by the use of globes of glass of more or less opacity. This, however, is an expensive remedy, as a great percentage of the electrical energy is wastefully absorbed. Dealing now with the question of the light of coal gas, the products of the perfect combustion of gas are shown by the following formulæ:

Constituents of Gas before Combustion.		Products of Combustion.				
$H_2 + O$	=	H_2O, aqueous vapor.				
$CH_4 + 2O$	=	$2H_2O$	do	do	+ carbon dioxide	(CO_2)
$C_2H_4 + 3O_2$	=	$2H_2O$	do	do	+ do do	(CO_2)
$CO + O$	=	.....	.....		do do	(CO_2)

It will be seen that the products of coal gaseous combustion consist chiefly of aqueous vapor and carbon dioxide. Commonly, however, coal gas contains traces of the vapor of carbon bisulphide (CS_2). During the action of combustion, the carbon and sulphur of the latter are both oxidised; the former passing off as carbon dioxide, and the latter as sulphuric acid (SO_2). It is this latter deleterious and common constituent which causes the products of even perfect combustion to be so objectionable, as the least traces of the sulphuric acid in the atmosphere may do incalculable damage to articles of *vertu*, plate, pictures, etc. If coal gas is imperfectly oxidised, from deficiency of air or defective burners, carbon monoxide (CO) forms a constituent of the products of combustion. Carbonic oxide is also highly deleterious. Besides the gaseous products of combustion already enumerated, there is, of course, the nitrogen set free from its mechanical combination with the oxygen. This gas *per se* is harmless; but Dr. Frankland suggests that there is a possibility of its forming in the zone of combustion a chemical combination with the nitrogen, with a resultant production of nitric acid (N_2O_5); but as the temperature of combustion of coal gas under ordinary conditions is only about 2,200° Fahr., this chemical action is hardly possible. The temperature of the voltaic arc which produces the nitric acid has been estimated to be equal to more than 7,000° Fahr. Carbon dioxide (CO_2) forms a great percentage of the products of gaseous combustion. This gas occupies only a decimal proportion (generally about 0.04 per cent.) of pure atmospheric air (or 1 volume of carbon dioxide in every 2,500 volumes of atmospheric air). To be hygienically suitable for human respiration, atmospheric air should never have a greater percentage than 0.06 of carbon dioxide. It will be clearly apparent to the reader that it would be impossible to retain the narrow limit of 0.02 per cent. of carbon dioxide in any habitation in which the products of gaseous combustion are allowed to disseminate; consequently, it should be considered a *sine qua non* that channels for the entire removal of the products of gaseous combustion to the external air should be fixed to all internal gas-burners used for illuminating domestic or industrial structures. The greatest disadvantage of the system of coal-gas lighting would thus be removed. By means of a simple arrangement, most gas-burners could be made to efficiently ventilate the rooms which they illuminate; for instance, the admirable sun-burner. For every volume of gas perfectly consumed in a room, 5 volumes of atmospheric air will be displaced, and this displacement alone in the air of the room would produce a beneficial circulation of the air. But by the utilization of the heat evolved by the combustion of the gas, and the high temperature of the products of combustion, to produce a displacement of the air by creating a draught, the temperature evolved by the combustion of the gas of a single 3 feet burner would create such a displacement and consequent renewal of fresh air as would be sufficient for one mature person. By the regenerative system, as carried out in the Siemens, Grimston, and other gas-burners, the intensity of combustion can be increased to as high a point as is properly consistent with the hygienic laws affecting the vision; that is to say, the light is so intense that its rays, instead of being so objectionably yellow (as are the ordinary gas lights), are so white and neutral as to permit colors of the most delicate hues to be easily distinguished. By the adoption of channels for the purpose of entirely removing the products of combustion to the external air, combined with means for the utilization of the temperature of combustion for ventilating purposes, along with the system of gaseous combustion arranged on the regenerative principle, the light of coal gas may be considered not only hygienically perfect, but, to the extent that it is utilized for assisting the most important source of ventilation, is superior to the electric light of the most perfectly hygienic type—viz. the incandescent light *in vacuo*.

The Products of Combustion from Coal Gas, Oil, and Candles.

By Norton H. Humphrys.

Mr. Norton H. Humphrys contributes to the *Journal of Gas Lighting* the following interesting article on the above-named subject:

For reasons which are not very obvious, and probably based in no small degree upon prejudice, the general popular impression respecting the products of the combustion of coal gas is that they are considerably more deleterious to health than those resulting from oil, candles, or in fact any ordinary combustible. But on looking fairly into the question of the products of the combustion of gas, as compared with those of oil, candles, or coals, the impartial observer cannot but be struck by the fact that, of the substances named, coal gas contains the smallest percentage of carbon, and therefore produces proportionately less carbonic acid than the others. More than one eminent authority has called attention to this fact, and remarked that, light for light, coal gas is the least insalubrious of any illuminant known. In the complete combustion of gas, oil, or candles, the ultimate products are alike—carbonic acid and water; and it is the former substance only that really vitiates the atmosphere.

No apology is needed for drawing attention to the already tolerably well-known fact that gas is, light for light, more salubrious—or, rather, less insalubrious, inasmuch as it produces a less quantity of carbonic acid—than candles or any of the various kinds of oils or petroleum; because the question of the products of combustion has frequently been brought forward, by persons interested in the electric light, as one of the disadvantages attendant upon the use of coal gas, and has been treated with that disregard of scientific truth, in the desire to appeal to popular prejudice, which has been a marked characteristic in the prospectuses of many companies formed for the purpose of introducing electric light. It has not actually been stated that the carbonic acid and water produced by the combustion of coal gas are more poisonous or more destructive to property than the carbonic acid and water produced by the combustion of coal, oil, or candles; but in many instances the public have been left to infer that such is the case, or that the combustion of coal gas must be attended with the production of some other substances of poisonous properties that are not present in the burning of oil or candles.

Here we may be reminded of the renowned "sulphur compounds" in coal gas. It has been observed that these are not only harmless, in the infinitesimal quantity in which they are produced by the combustion of coal gas, but positively advantageous. Certain it is that people who can tolerate the quantity of sulphur that is carried into our atmosphere by the combustion of coal need not trouble themselves about the comparatively minute quantity that is contributed thereto through the medium of coal gas. Indeed, it is a standing joke among engineers on the Continent and in America that people who do not object to any amount of sulphur from coal, should trouble themselves about that produced from coal gas. With the proportion of sulphur reduced to 20 grains per 100 cubic feet—a method of expression that conveys an exaggerated idea to the general public, who are accustomed to estimate quantities by percentages—an ordinary gas burner must be in action for one hour before it will evolve as much as 1 grain of sulphur. And this insignificant quantity is not more than might be contributed to the atmosphere from other sources, such as the striking of a lucifer match. Stated in percentage by weight, which is an expression that is not likely to be misunderstood, the percentage of sulphur in coal gas is less than 0.1. So it is evident that sulphur cannot have anything to do with the alleged poisonous properties of coal gas products.

The question may be raised whether the combustion of coal gas is complete—whether its constituents combine with their maximum quantity of oxygen, and are completely converted into carbonic acid and water; or whether the combustion may not be attended by the formation of carbonic oxide, aldehyd, or other substances that would be the result of incomplete oxidation. It is *possible* for incomplete combustion to obtain, but of the three substances coal gas is the least likely to be liable thereto; for since it contains the least proportion of carbon, it also contains the largest proportion of hydrogen. It is well known that the affinity of hydrogen for oxygen is so strong that it will not escape combustion so long as there is a sufficient supply of air. And its aid as a heat producer is necessary to secure the complete oxidation of the carbon. Therefore, the greater the proportion of hydrogen the less must be the chance of imperfect combustion; and some advantage may be claimed for coal gas in this respect, as compared with the other illuminants. This is exemplified every day; for gas jets may frequently be seen burning in places where, on account of the exposed position, the use of candles or oil would be quite impracticable. And although, unfortunately, there are many appliances in common use that do not secure proper and complete combustion, still it is not too much to claim that the means of obtaining such are ready to hand.

Since the ultimate products of combustion are the same with each substance respectively, it follows that their relative hygienic value will vary inversely according to the quantity of carbonic acid produced, and the oxygen that is used, by the flame; and it is very desirable that some accurate experiments as to the oxygen-consuming power of a gas burner, an oil lamp, and a number of candles respectively, so arranged as to give an equal amount of light, should be made. But, failing these, there are a few data available which will admit of a rough-and-ready comparison. Taking as a standard a light of 16 candles for one hour, 5 cubic feet of common gas would be required for this purpose. Since sperm candles burn (or ought to burn) at the rate of 120 grains per hour, the quantity of sperm required to produce a similar amount of light would be $120 \times 16 = 1{,}920$ grains. The French standard of light is the Carcel lamp, which gives a light equivalent to 9.6 candles, with a consumption of 648 grains of colza oil per hour. A simple rule-of-three sum shows us that the quantity of colza oil needed to produce a light of 16 candles for one hour is 1,080 grains. To produce an equal quantity of light, we require either 5 cubic feet of common gas, 1,920 grains of sperm candles, or 1,080 grains of colza oil. Since these three examples are all used as standards, they may be supposed to represent the best methods of using each source of light respectively, and therefore afford fair examples for a comparison of the respective merits or demerits of gas, candles, or oil.

The next step is to calculate the quantity of carbonic acid and water produced by the combustion of these quantities respectively. Common coal gas contains approximately 60 per cent. by weight of carbon and 30 per cent. of hydrogen, the remainder being oxygen, nitrogen, etc.; and (calculating from the mean of several different analyses) it would produce, by the combustion of 5 cubic feet, 2,277 grains of water vapor and 2,321 grains of carbonic acid. The approximate composition of sperm candles is, in percentage by weight, 86 of carbon, 7 of hydrogen, and 7 of oxygen. Therefore 1,920 grains would contain 1,651.2 grains of carbon and 134.4 grains of hydrogen, and would yield on combustion 5,954.4 grains of carbonic acid and 1,209.6 grains of water vapor. Pursuing the same plan with regard to colza oil, we find that the 1,080 grains would comprise 880 grains of carbon and 108 grains of hydrogen, and would yield 3,226 grains of carbonic acid and 972 grains of water vapor.

In considering the vitiating effect of these substances respectively, it is scarcely necessary to take into account the production of water vapor, because it is found that, with all the substances, the production of water vapor is an advantage in some respects, and that, so far from any excess of water vapor being complained of, the usual complaint with artificial lights is that they cause a "dryness" of the air; while, singularly enough, the one most frequently blamed in this respect is coal gas, which produces the largest quantity of water vapor. It will be interesting to compare these results with the quantity of carbonic acid and water vapor produced by a human being. Professor Huxley states that an adult person of average weight exhales rather more than 500 grains of carbonic acid and about 600 grains of water vapor per hour. From these factors are obtained the third and fourth lines of the following table, which illustrates, in an understandable form, the result of using artificial lights in closed rooms. It appears that one gas light burning 5 cubic feet per hour is equivalent in carbonic acid producing power to nearly five persons; while the same amount of light in candles would be nearly equivalent to the presence of ten persons in the room. With regard to the formation of water vapor, it should be remarked that although this is harmless in itself, it represents an impoverishment of the air, inasmuch as every 9 grains of it comprise 8 grains of oxygen. But the probability is that the poisonous property of the carbonic acid would affect a human being long before he suffered from the absence, or the diminished quantity of oxygen due to the formation of water; for Professor Huxley estimates that the carbonic acid should not be allowed to rise higher than 1 per cent., and 3 or 4 per cent. of it are found to produce serious inconvenience.

We may now put our results in tabular form for the purpose of comparison:

	Gas.	Oil.	Candles.
Carbonic acid.....	2,321 grs.	3,226 grs.	5,954 grs.
Water vapor.....	2,277 grs.	972 grs.	1,210 grs.
Vitiating power, stated in adult persons—			
Carbonic acid.....	4.6	6.4	9.5
Water vapor.....	3.3	1.6	1.9
Total.....	7.9	8.0	11.4
Oxygen used.....	3,844 grs.	3,220 grs.	5,369 grs.
Approximate heat produced.....	3,500 units.	2,400 units.	5,400 units.

The above table illustrates the fact to which allusion has already been made, that coal gas produces the smallest proportion of carbonic acid and the largest proportion of water vapor. In total vitiating effect it is about the same as oil. It is interesting to observe that candles (which are sometimes preferred for drawing rooms, ball rooms, etc., on account of their supposed non-heating qualities) are altogether the worst of the three illuminants; producing more than twice as much carbonic acid, consuming half as much

again of oxygen, and evolving half as much again of heat, as the abused coal gas. Oil offers some advantage in not requiring so much oxygen as coal gas; but this is quite counterbalanced by the extra amount of carbonic acid it produces. Also in heat producing power it is less than gas. This item, however, is not of much importance; for where sufficient ventilation obtains to convey away properly the products of combustion, and to supply the needful quantity of fresh air for human beings, this heat is so diffused and diluted as to offer no practical inconvenience.

These facts ought, in the interest of coal gas, to be made known widely, not only to users of this illuminant, but to those who prefer oil or candles, and thus imagine they secure a more salubrious atmosphere. The foregoing table quite proves the assertion made at the commencement of this article, that, light for light, coal gas is less insalubrious than either oil or candles; and that the very general opinion to the effect that gas is more unwholesome than lamps or candles has no foundation in fact.

Beacon and Buoy Illumination.

Mr. J. M. Foster, President and Constructing Engineer of the United States Beacon Light and Signal Company, sends the following communication relative to the article which appeared in the last issue of the JOURNAL on "Gas for Lighting Beacons and Buoys." In justice to the United States Beacon Light and Signal Company we cheerfully publish Mr. Foster's letter.

To the Editor AMERICAN GAS LIGHT JOURNAL:

Referring to the article in your issue of May 2, under the head of "Gas for Lighting Beacons and Buoys," in which you quote a communication addressed to the Hon. Secretary of the Treasury by the Chairman of the Lighthouse Board, some explanation is necessary to a fair understanding of the subject, in order to avoid an injustice to the Foster system.

1st. The beacons in Currituck Sound, when fully charged, will burn more than sixty days continuously, and without any attention.

2d. The occasional extinguishment of these lights is due to no imperfections of the system or apparatus, but solely to an imperfectly ventilated lantern which was furnished by the Lighthouse Department. An improved lantern, subsequently placed on one of the beacons by Mr. Foster, has worked perfectly.

3d. The gas lights are decidedly more reliable than the oil lights formerly used at those stations, and never vary in their intensity, nor become dim, as stated in the report, except for want of ventilation or exhaustion of the gas. In proof of this extracts from letters received from parties constantly navigating those waters are appended.

4th. The Foster buoy referred to as having been placed near Fourteen-foot Bank Lightship had formerly burned in the upper Delaware for four months without recharging and without extinguishment; it was then taken down to the station named for further experiment in a heavy sea. After a trial of 30 days it was found that the salt air caused a condensation in the hot air tubes, which cut off the supply of oxygen and extinguished the light. In an improved buoy, now nearly completed, and which will be placed in New York Bay, this difficulty has been overcome and many valuable improvements added which will tend to increase its efficiency.

From Capt. R. H. Cannon, steamer Experiment: "I have been navigating the Currituck Sound for a number of years, and I find the Foster gas-lighted beacon far superior to the oil lights formerly in use."

From Capt. Wm. H. Pierce, steamer Defiance, Clyde's lines: "I have to acknowledge receipt of your communication of late date relative to the efficiency of your gas-lighted beacons now in use in Currituck Sound. In reply I have to state that during the two years they have been in operation I have observed their working and value, and pronounce them indispensable aids to commerce and navigation, far superior to the former system of oil lights, because they show a brighter flame, and may be seen at a greater distance."

From Capt. E. D. Poiner, commanding steamer Defiance: "I have had many opportunities for observing the workings of your gas-lighted beacons in Currituck Sound, and have found them superior to other lights. I have been navigating the North Carolina Sounds during the whole time these beacons have been in operation, and in clear weather have seen the lights fully ten miles."

From Capt. J. W. Thomas, steamer Astoria: "In regard to your beacon lights in Currituck Sound, they are visible nine or ten miles, and are of great benefit to navigation. I consider them much better than the old system of oil lights."

From Wm. P. Clyde & Co., General Agents: "In reply to your favor in regard to your gas-lighted buoy, would say that the captains and officers of our steamers navigating the Delaware all speak of it in the highest praise, and say that its adoption would be of great service to all navigators."

From Capt. W. B. Gallagher, Supt. Philadelphia and Reading Railroad Company's Steam Colliers: "In reference to the gas lighted buoy which was moored in the River Delaware and Bay for nearly six months, I would state that our company own and operate thirteen steam colliers in the coal trade between Philadelphia and Eastern ports, they making on an average, 484 voyages, and carrying 568,683 tons of coal per annum. Our captains are all of one opinion regarding the Foster Gas Lighted Buoy as being the best they have seen, and they further say that they saw the buoy on the worst nights, showing a steady and brilliant light, which they could distinguish about the same time they made the Light Ship on Fourteen-foot Bank, a distance of from six to eight miles off. I feel satisfied if this buoy is adopted it will assist navigators materially in the dark, stormy nights, thereby saving life and valuable property. I hope the government may speedily adopt it, and have it placed on all dangerous shoals on our coast, bays and rivers.

From Capt. Jacob Swain, Str. Rattlesnake, Philadelphia and Reading R. R. Collier Line: "I am happy to say to anyone who takes an interest in our commerce that, in my opinion, your gas lighted buoy is one of the greatest improvements I have ever seen, and in time it will be considered as indispensable. It is a safeguard to life and property, against the dangers that exist upon our coast, bays, lakes and rivers. I have closely observed your buoy ever since it was placed in the Delaware River, at Port Richmond (July 1, 1882) until its removal to Delaware Bay, and I was delighted with its workings. I saw it in the bay, on the night of October 13, it being stormy and blowing from the N. E., causing a chop sea on the station, my ship laying about three miles above the buoy, it being too rough to go to sea, and its working was all that could be desired. I also saw it on the night of October 21, whilst at anchor above it; wind N. N. E., fresh breezes and chop sea. Buoy working all right, and I also saw the light plainly on the morning of October 22, at a distance of six miles.

How Reducing the Price Affected the Sales of Gas in Jamaica Plain, Mass.

Appended to the Report of the Jamaica Plain (Mass.) Gas Light Company (an abstract of which will be found in our "Item" columns) is a statement to the stockholders of the company, made on behalf of the Directors, by the President, Mr. John C. Pratt, as to the experience of the company in the matter of reduced price of gas as affecting the yearly send-out. The experience of Mr. Pratt, in this matter, appears to be in direct conflict with that obtained by other managers both in this country and abroad. It will be noticed that Mr. Pratt thoroughly understands that the greatest competitor of the gas lighting interest in America is to be found in kerosene. While his company have not met with as much success in increasing production, by cheapening the price to the consumer, as some of his brother managers have done, it will be noticed that he still thinks this course of action the proper one to pursue; as witness the fact that the Jamaica Plain Company still further reduced the price of gas, by 25 cents per thousand, on April 1, of this year. Mr. Pratt's statement is as follows:

It is the very general belief that a reduction in the price of gas is speedily compensated to the Company by a corresponding increase in consumption. Our experience does not sustain this opinion, as the following figures will demonstrate:

On the first of April, 1876, we made a reduction of 12½ per cent. in our price, and that year the quantity of gas consumed was 9 per cent. less than before the reduction was made. The following year we made a further reduction of 12½ per cent., which was followed by gains in the six succeeding years, ending April 1, 1883, amounting to 24¼ per cent., making an aggregate of increase in consumption of 15¾ per cent., against the reduction of 25 per cent. in price, so that our net receipts are about 10 per cent. less than they were in 1876, before we reduced our price. Why is this? The answer is, the use of kerosene oil to a greater or less extent in almost every family. It is kerosene and not the electric light that gas companies have to compete with. While on the other hand, the electric light is a luxury so expensive that few can afford to indulge in, and cannot as at present developed, for this reason, gain any considerable foothold as an illuminator for the people—on the other hand, kerosene is so cheap an illuminator that no price at which gas can be furnished, if convenience, comfort, and safety are not to be considered, can prevent or discourage its use.

At least 500 of our customers have a kerosene lamp every night upon their center-tables, and yet an Argand burner, giving as good if not a better light than any Duplex or Student lamp, and saving the trouble and inconvenience attending the use of oil, can be burned at a cost of less than a cent and a half an hour, perhaps 3 cents per night more than the cost of oil; and this single light if substituted for oil, at so trifling a cost to the consumer, would add, on an average burning of three hours per night, 25 per cent. to our net receipts, from private consumption, and materially aid us in reducing the price of gas.

It is clear that if any reduction is made, we cannot rely upon any increase

in consumption to compensate us ; whatever reduction we make must be based upon the more economic manufacture of gas, which we hope to realize by our new and improved works.

We have always claimed that our stockholders were entitled to 8 per cent. on their capital—the risks and uncertainties of the business entitle them to this—and all over and above that interest, after reserving a moderate amount for depreciation, we have given and propose to continue to give to our customers in the price we charge them.

It is proper to add, in reply to the oft-repeated complaint that our price is higher than in Boston and other neighboring places, that the cost of gas depends more largely than almost any other industrial interest upon the quantity manufactured and sold. Boston sells 850,000,000 feet ; Roxbury, 125,000,000 ; Cambridge, 75,000,000 ; while we sell 23,000,000 feet—hence the difference in price. We average about forty consumers to the mile of street mains. Let any one compare and estimate, if he can, the difference between this and the number per mile in the densely populated places referred to, where continuous blocks of stores and dwellings line on both sides the mains of the companies.

As our population increases this great disparity will gradually disappear, but it is a slow process ; as in 10 years we have set only 170 new meters, our present number being about 750.

After this statement of the business of the company, and with a strong disposition to meet every reasonable demand to our customers, we have decided to make a reduction of 25 cent per 1,000 feet from April 1, 1883.

We do this in the belief that with continued and careful management we can maintain our present rate of dividends and keep our works in good condition and repair.

We can make no promises for the future, except that we consider our interests and those of the public to be so closely identified that further reductions will be made as fast as the interests of our stockholders will warrant.

Lessening the Fire Risks of Electric Lighting.

The Society of Telegraph Engineers and of Electricians, London, England, through a committee composed of representatives of both bodies, have submitted the following revised rules to govern the installation of electric lighting plant. It will be noted that the rules previously published by us in 1882 have undergone but slight change.

The committee state that these rules and regulations are drawn up for the reduction to a minimum, in the case of electric lighting, of those risks of fire which are inherent in every system of artificial illumination, and also for the guidance and instruction of those who have, or who contemplate having, electric lighting apparatus installed in their premises. The difficulties that beset the electrical engineer are chiefly internal and invisible, and they can only be effectually guarded against by "testing" or probing with electric currents. They depend chiefly on leakage, undue resistance in the conductor, and bad joints, which lead to waste of energy and the dangerous production of heat. These defects can only be detected by measuring, by means of special apparatus, the currents that are either ordinarily, or for the purpose of testing, passed through the circuit. Should wires become perceptibly warmed by the ordinary current, it is an indication that they are too small for the work they have to do, and that they should be replaced by larger wires. Bare or exposed conductors should always be within visual inspection, and as far out of reach as possible, since the accidental falling on to, or the thoughtless placing of other conducting bodies upon such conductors would lead to "short circuiting," and the consequent sudden generation of heat due to an increased current in conductors not adapted to carry it with safety. The necessity cannot be too strongly urged for guarding against the presence of moisture and the use of "earth" as a part of the circuit. Moisture leads to loss of current and to the destruction of the conductor by electrolytic corrosion, and the injudicious use of "earth" as a part of the circuit tends to magnify every other source of difficulty and danger. The chief dangers of every new application of electricity arise from ignorance and inexperience on the part of those who supply and fit up the requisite plant. The greatest element of safety is therefore the employment of skilled and experienced electricians to supervise the work.

I.—THE DYNAMO MACHINE.

1. The dynamo machine should be fixed in a dry place.
2. It should not be exposed to dust or flyings.
3. It should be kept perfectly clean and its bearings well oiled.
4. The insulation of its coils and conductors should be practically perfect.
5. All conductors in the dynamo room should be firmly supported, well insulated, conveniently arranged for inspection, and marked or numbered.

II.—THE WIRES.

6. Every switch or commutator used for turning the current on or off hould be constructed so that when it is moved and left it cannot permit of a ermanent arc or of heating.
7. Every part of the circuit should be so determined that the gauge of wire to be used is properly proportioned to the currents it will have to carry, and all junctions with a smaller conductor should be fitted with a suitable safety fuse or protector, so that no portion of the conductor should ever be allowed to attain a temperature exceeding 150° F.
8. Under ordinary circumstances complete metallic circuits should be used ; the employment of gas and water pipes as conductors for the purpose of completing the circuit should not in any case be allowed.
9. Bare wires passing over the tops of houses should never be less than 7 feet clear of any part of the roof, and all wires crossing thoroughfares should invariably be high enough to allow fire escapes to pass under them.
10. It is most necessary that joints should be electrically and mechanically perfect and united by solder.
11. The position of wires when underground should be clearly indicated, and they should be laid down so as to be easily inspected and repaired.
12. All wires used for indoor purposes should be efficiently insulated, either by being covered throughout with some insulating medium, or, if bare, by resting on insulated supports.
13. When these wires pass through roofs, floors, walls, or partitions, or where they cross or are liable to touch metallic masses, like iron girders or pipes, they should be thoroughly protected by suitable additional covering ; and where they are liable to abrasion from any cause, or to the depredations of rats or mice, they should be efficiently enclosed in some hard material.
14. Where indoor wires are put out of sight, as beneath flooring, they should be thoroughly protected from mechanical injury, and their position should be indicated.

N.B.—The value of frequently testing the apparatus and circuits cannot be too strongly urged. The escape of electricity cannot be detected by the sense of smell, as can gas, but it can be detected by apparatus far more perfect and delicate. Leakage not only means waste, but in the presence of moisture it means destruction of the conductor and its insulating covering by electric action.

III.—LAMPS.

15. Arc lamps should always be guarded by proper lanterns to prevent danger from falling incandescent pieces of carbon, and from ascending sparks. The globes should be protected with wire netting.
16. The lanterns, and all parts which are to be handled, should be insulated from the circuit.

IV.—DANGER TO PERSON.

17. Where bare wire out of doors rests on insulating supports, it should be coated with insulating material, such as india-rubber tape or tube, for at least two feet on each side of the support.
18. To secure persons from danger inside buildings, it is essential so to arrange and protect the conductors and fittings that no one can be exposed to the shocks of alternating currents of a mean electro-motive force exceeding 100 volts, or to continuous currents of 200 volts.
19. If the difference of potential within any house exceeds 200 volts, the house should be provided with a "switch," so arranged that the supply of electricity can be at once cut off.

Cements for Iron.

The following useful receipts for cements for iron are taken from the *Technische Commerz Zeitung :*

Cement which Resists Heat and Water.—Lime, 10 parts ; iron filings, 5 ; vinegar, 2 ; water, 3.

Black Iron Cement for Iron Ovens.—Iron filings, 10 parts ; sand, 12 ; bone-black, 10 ; slaked lime, 12 ; lime milk, 5.

Cements for Objects which have to be Heated.—Iron filings, 100 parts ; clay, 50 ; common salt, 10 ; quartz sand, 20.

Cement for Fastening Iron to Stone.—Fine iron filings, 10 parts ; plaster of paris, 30 ; sal-ammoniac, ½. These are mixed to a fluid paste with weak vinegar, and used at once.

Cement for Iron Cisterns.—Finest iron filings are mixed with vinegar into a paste, which is left to stand until it becomes brown ; the mass is then pressed into the joints.

Fire-proof Cement for Iron Pipes.—Wrought-iron filings, 45 parts ; clay, 20 ; china-clay, 15 ; common salt solution, 8. If china-clay cannot be found, fire-clay will serve the purpose instead.

Ammonia Iron Cement.—Iron filings, 100 parts ; sal-ammoniac, 2 ; water, 10. This cement begins to rust after some days, and becomes very strong, and is proof against water and steam.

Cement for Annealing Boxes.—Iron filings, 100 parts ; lime milk 40 ; quartz sand, 50 ; vinegar, 20. These are worked with water into a paste, to which may be added, to render the mass more porous, hair, sawdust, etc.

Iron Cement for Hermetically Closing Stove Doors.—Finest iron filings, 100 parts ; sal-ammoniac, 10 ; limestone, 10 ; soluble glass solution, 10.

These are mixed with water to a thick paste, which is applied at once, and is left to dry slowly before heating.

Cement for Broken Iron Vessels.—Iron filings, 10 parts; clay, 60. These are worked with linseed oil into a thick paste, which is applied after some more linseed oil has been add.d to it, and left to dry slowly.

Rust Cement for Iron—Wrought-iron filings, 65 parts; sal-ammoniac, 2½; sulphur (flowers), 1½; sulphuric acid, 1. The solid ingredients are mixed dry, sulphuric acid diluted with sufficient water being then added. This cement dries after two or three days, and unites with iron, making a very resisting and solid mass.

Cement for Filling Faults in Castings.—Iron filings, free from rust, 10 parts; sulphur, ½; sal-ammoniac, 0.8. These are mixed with water to a thick paste, which is rammed into the "faults." This becomes strong when the iron filings are rusted, The parts which have to be cemented are treated before the operation with liquid ammonia, so as to be perfectly free from grease.

Fire-proof Cement.—(1) Iron filings, 140 parts; hydraulic lime, 25; quartz sand, 25; sal-ammoniac, 3. These are formed into a paste with vinegar, and then applied. This cement is left to dry slowly before heating. (2) Iron filings, 180 parts; lime, 45; common salt, 8. These are worked into a paste with strong vinegar. The cement must be perfectly dry before being heated. By heating it becomes stone hard.

[Official Report.]

Sixth Annual Meeting of the Western Gas Association.

Held at the Burnet House, Cincinnati, Ohio, May 9, 10, and 11, 1883.

The Sixth Annual Meeting of the Western Gas Association was convened at the Burnet House, Cincinnati, Ohio, at 10 o'clock A.M. on Wednesday, May 9, the President, Mr. J. B. Howard, of Dubuque, Iowa, in the Chair. The Chairman congratulated the members on the large attendance present, and alluded to the auspices under which the Association met as promising a meeting of more than usual interest.

The following members reported as present:

Wm. Wallace, Lafayette, Ind.	T. A. Cosgrove, Evanston, Ill.
G. B. Burns, Pullman, Ill.	E. Lee Brown, Chicago, Ill.
T. G. Lansden, St. Louis, Mo.	R. Salter, Covington, Ky.
E. J. King, Jacksonville, Ill.	G. A. Hyde, Cleveland, Ohio.
A. W. Littleton, Quincy, Ill.	G. A. Hyde, Jr., Sidney, Ohio.
M. Moran, Joliet, Ill.	B. W. Perkins, South Bend, Ind.
J. K. Mitchell, Galesburg, Ill.	H. Harthan, Selma, Ala.
J. W. Butman, Decatur, Ill.	J. Somerville, Indianapolis, Ind.
Thos. Butterworth, Rockford, Ill.	R. Spencer, Burlington, Iowa.
Thos. A. Bates, Cairo, Ill.	J. Fullager, Cincinnati, Ohio.
J. Gimper, Leavenworth, Kan.	John Dell, St. Louis, Mo.
G. G. Ramsdell, Vincennes, Ind.	L. J. Howard, St. Louis, Mo.
J. B. Howard, Dubuque, Iowa.	H. C. Thompson, Cincinnati, Ohio.
A. F. Averill, Cedar Rapids, Iowa.	Carroll Collins, Des Moines, Iowa.
T. Smith, Grand Rapids, Mich.	A. D. Cressler, Fort Wayne, Ind.
J. H. Walker, St. Louis, Mo.	G. E. Downing, New York, N. Y.
H. H. Sheldon, Providence, R. I.	A. T. Prentiss, Chicago, Ill.
J. M. Kennedy, Rockford, Ill.	J. Montgomery, Sedalia, Mo.
F. Beck, Galveston, Texas.	S. H. Douglas, Ann Arbor, Mich.
C. M. Keller, Columbus, Ohio.	J. G. Miller, Green Bay, Wis.
J. R. Smedberg, Lancaster, Pa.	Z. T. F. Runner, Freeport, Ill.
Wm. Stacey, Cincinnati, Ohio.	J. M. Starr, Richmond, Ind.
W. A. Agard, Des Moines, Iowa.	J. Long, Louisville, Ky.
T. G. Foster, Montgomery, Ala.	R. T. Coverdale, Rome, Ga.

On motion of Mr. E. J. King, of Jacksonville, Ill., the reading of the minutes of the last meeting was dispensed with.

The Association then listened to the reading of the President's address, which was as follows:

President's Address.

Members of the Western Gas Association: Gentlemen—One of the greatest victories man can win over himself is to judge candidly, truthfully, and impartially, upon any question in which he is himself vitally interested.

We are engaged in the manufacture and sale of coal gas, and being interested parties, we are, perhaps, in danger of looking with a jealously perverted eye upon any innovations, which we imagine may, in any manner, interfere with our own particular business.

I trust, however, we shall all recognize the fact that we meet here as seekers after truth; and not to combat new inventions, or endeavor to set at naught discoveries in the field of illumination, a field which we have heretofore considered our own.

The present century has been indeed a century of wonders, surpassing even the conceptions of the wizards of antiquity. Marvelous discoveries, and their practical application, have followed each other in such rapid succession, that our credulity is scarcely tasked by any announcement, however impossible of accomplishment it may, at first, seem.

Among the many great discoveries which have contributed so much to the comforts of man, that of gas lighting occupies no mean place.

The source of all light, heat, and power is our great luminary the Sun. Untold epochs of time before the creation of man, "Old Sol" was depositing his forces on our globe, slowly but surely, and preparing it for our future habitation.

In the early ages of the world, men knew but little of the planet they lived upon; and absolutely nothing of the laws that governed it, or the hidden treasures it had stored away for them, awaiting only to be harnessed in at their bidding, and shower down upon them a wealth of comforts and pleasures.

Coal may be called condensed sun-light; but it was not until a very recent date that the dirty black diamonds were found to possess the quality of convertibility into a brilliant luminant.

Inflammable air issuing from the bowels of the earth is recorded by ancient writers; and, in 1658, Thomas Shirley read a paper before the Royal Society of England, on his observations and experiments with gas issuing from a spring in the rocks, which the peasantry asserted was burning water, but which he demonstrated proceeded from a substratum of coal.

About the middle of the eighteenth century, the mode of extracting gas from coal, by distillation, seems to have been discovered; and in the period between 1740 and 1790 many experiments were made in the distillation of coal; but only for philosophical purposes. It was not until 1792 that any effort was made to apply these experiments to practical uses.

In that year, Mr. William Murdoch, a Scotchman, lighted his dwelling and office at Redruth, in Cornwall, with coal gas. This was undoubtedly the first gas apparatus ever constructed for permanent house lighting. He conducted the gas through copper and tin pipes to his house, a distance of over 70 feet.

In 1798 he erected a small gas apparatus for Boulton & Watt, at Soho, which was used on the occasion of a general illumination over the Peace of Amiens.

Mr. Murdoch was constantly experimenting during this period; and, like Mr. James Watt, seemed to possess the rare qualities of clear conception, and logical deduction, coupled with patient investigation.

In 1803 he lighted the entire works of Boulton & Watt. His retort was a long vertical pot, and the gas was conveyed to a holder, having a capacity of about 300 cubic feet, and from thence through copper pipes to the shops.

The apparatus would undoubtedly now be considered a very crude one; but it was looked upon at that time as something wonderful.

We may mention here as a rather ludicrous incident connected with the first attempts at introducing gas light in cities, that when Mr. Murdoch was examined before the English Parliament, on the occasion of a bill being introduced, asking the privilege of lighting part of London with gas, a member of Parliament asked him if he intended to give them light without the use of a wick; and when answered in the affirmative, remarked, "Ah, my friend, you are asking us to believe too much."

Coal gas may with truth be said to have illuminated the path of advancing civilization. To-day it encircles the whole earth; every city, nay, almost every village, has its gas works.

Its manufacture is one of the great industries of the world; and we who meet in this convention are but a very small part indeed of the great army engaged in its production.

This is an age of books, and of papers, the diffusion of knowledge is now made swift and certain; we may take our morning paper and at breakfast, converse with, and receive the ideas of, one who may have discovered something useful, though he live a thousand miles away; nay, even though 3,000 miles of ocean intervene between us.

As the world is now constituted, there is but little excuse for ignorance; and yet we may truly say that there are many, very many, little details in the minutiæ of our profession where conversational interchange of ideas, questions, and answers, as they come up, may give us useful points of knowledge, that we could scarcely hope to receive, either from pen or press; and I most sincerely hope that each one of us will feel that he is here not only to receive, but to impart to his fellow members all the knowledge in gas matters he may possess.

Many of us are managers of small works; and are perhaps apt to imagine that only engineers of prominence and celebrity are able to advance new ideas, or to clearly observe the causes which lead to many of the difficulties we have to contend with, and to suggest the remedy; but this idea is entirely wrong. There are over 100 members in our Association; and it would be strange indeed, if, in the interval elapsing between one meeting and another, some one of us should have not made some new observations, or, per

haps, introduced new methods into our works, which would be beneficial to all; and, if so, I hope such will feel it to be their duty to communicate them at this meeting.

There is no limit to the requirements of man. What was yesterday a luxury is to-day a necessity; but any conveniences, especially those of a domestic character, can never be universally adopted unless they be safe, cheap, and easy to manage—and these three qualities belong eminently to the domain of gas lighting.

Many an enthusiastic inventor has spent time and money in producing something which seemed to him a complete success; and which was, in reality, a success, so far as doing all that it was expected to do was concerned; but, when the effort was made to introduce it, it failed of success, and only for the reason that some labor, and perhaps a little ingenuity, was required for its manipulation.

The great success (and, I may say, almost universal adoption) of gas lighting, is no doubt due, in great part, if not altogether, to the fact that there is absolutely no labor connected with its management. The light is mellow and brilliant; and by the simple turning of a cock, it may be gauged down to a mere peep; it is free 'rom odor; and, day by day, month by month, and year by year, it is at all times ready, willing, and obedient. To use a common phrase, there are no kinks about it; nothing to get out of order, or require any fixing; no engineering necessary to enable it to perform its part at all times faithfully and well. It has stood the crucial test, the test of time, having been in the harness for over 90 years.

Whether the new candidate for popular favor, as an illuminator, shall ever attain to any degree of permanent success, depends upon its possessing the qualities I have named; but for out-door lighting, and for large buildings, it has already pressed to the front, and is at the present time in use in most of the larger cities of the Union. The lights, however, have to be carefully tended, and an engineer kept for that purpose. Candor compels us, however, to admit that the electric light is a very beautiful and brilliant one, and perhaps has a place or sphere peculiarly its own, which it may attain and hold.

To be sure, the incandescent light can be turned off and on like gas; but one peculiarity of electric lighting is the fact that, as the size of the light is reduced, the proportionate cost of producing it is very largely increased; and, as we view the entire field at present, there is nothing in the electric light that gas companies may fear.

We may mention as a remarkable fact that, since the introduction of the electric light, the consumption of gas has very largely increased; and the most notable increase has been in those cities where electricity has pushed its claims the hardest.

There are, however, uses to which gas may be applied successfully other than those of lighting; and to these I desire briefly to call your attention.

We have now very superior gas cooking stoves; and I speak from experience when I say that for cleanliness, convenience, and handiness they are the nicest articles that were ever introduced into a kitchen. I have succeeded in introducing, in our town, quite a number of them; and in every case they have been pronounced a complete success; but, like every other novelty, it requires a little time to get the people to take hold of them, and a little effort on the part of gas men to introduce them.

They have no unpleasant odor, like the oil stove, and the same may be said of them that I said about gas lighting—there is no labor required to prepare them for active work but simply lighting a match and turning a cock. I think I am perfectly safe in saying that the present decade will see hundreds of thousands of them in use in this country.

We have also gas engines, which are being introduced all over the country with marked success; and this opens up another large field for gas consumption; and the fact that it is mostly a day consumption is a very important one, especially in cities that have almost outgrown the size of their mains. No one who has noticed these gas engines in operation can have failed to note their steady and reliable movement; and, although they are at present rather costly, there is no doubt but that, like other pieces of mechanism, they will be improved and cheapened. One of the beauties of the engine is that, when intermittent power is required, they are much less expensive to run than the steam engine, there being no cost except when the engine is actually in use. They do not require an engineer; and, for steady running, will compare favorably with steam engines from the sizes of 1 to 10 horse power.

I have briefly called your attention to the discovery of gas lighting, its introduction, wonderful growth, and future diversified uses. I have not done this with the idea of presuming that you are not fully aware of all the facts I have stated; but for the purpose of bringing the scenes that have at different times presented themselves to your vision in the gas world into one small picture, thus the better to enable you to view it in all its aspects.

With regard to the various details connected with gas manufacture and distribution, these will be treated in the various papers which will be read before you by different members of our Association; and I would urge it upon you that, whatever the subjects may be, they should be freely and fully discussed. Let none hold back from asking questions from the fear that they are perhaps showing ignorance. None of us know too much to learn, or too little to impart, knowledge. We are here to interchange views, and I hope we shall all do it in the fullest sense of the word. Should time permit, after the reading of the various papers, and the discussions following, I would suggest that, as a large majority of us are connected with small works, we discuss the following subjects:

The different methods of condensation.
Purification by the oxide and lime processess.
Hydraulic main, with and without dips.
Stopped ascension pipes; the cause and prevention.
Coke and tar for heating benches.
Which of the two exhausters is to be preferred, the steam jet or rotary?
What methods are best adapted for the prevention of naphthaline, and, when found, the best mode of clearing.
Clearing retorts of carbon.
Proving of meters.
Reducing leakage account.
What kind of burners are best adapted for street lighting and for use of private consumers?

Particular information on any of these subjects can but result in increasing our general stock of knowledge.

It is a source of joy and gratification to all to know that we meet again, at this our sixth annual convention, with unbroken ranks; and I hope those who succeed me in this chair, for many years to come, may echo these congratulations, from year to year, as we meet at our annual conventions.

We feel each year that we are becoming to know each other better and better; that what was at first a mere acquaintance is ripening into friendship. Many of us correspond freely with each other; and it is a great source of gratification to feel and know that should we desire information at any time on matters pertaining to our pro'ession, in writing to each other we are not addressing strangers, but friends. This free intercourse of thought and ideas cannot but be beneficial both to ourselves and to the interest we represent. Let no one of us imagine that he has reached the summit. We have a field that is ever widening before us, and one requiring constant care and watchfulness to master its every detail.

Every gas works possesses peculiarities belonging to itself, and demanding special knowledge and study. The work of a gas superintendent is not by any means routine work, as many outsiders suppose, for there are often new and unforseen difficulties arising which require patient investigation to overcome. The retort house may be called the heart of the whole plant; and upon its proper management depends, to a very great extent, the success of every gas works.

The past year has been a very prosperous one. Every branch of industry has felt the quickening pulse of increased and increasing demand. The giant "Republic of the West" is marching on with rapid strides, leaving hoary-headed Monarchy behind to follow with its load of standing armies and titled cumberers of the ground. With boundless territory, free institutions, fertile soil, and vast mineral wealth, who will set a limit on our future possibilities? Our empire is a continent, and our aim the universal brotherhood of man.

On motion, the President's address was referred to a committee composed of Messrs. Somerville, Butterworth, and Butman, for consideration and recommendations.

NEW MEMBERS.

Applications for membership were received from the following-named gentlemen:

C. H. Dickey, Baltimore, Md.
J. Anderson, Cincinnati, Ohio.
H. Pratt, Chicago, Ill.
A. C. Baxter, Jr., Lima, Ohio.
G. S. Page, New York, N. Y.
G. H. Tayler, Warren, Ohio.
J. Daniels, St. Louis, Mo.
S. Prichitt, Nashville, Tenn.
G. H. Wells, Nashville, Tenn.
R. H. Canby, Bellefontaine, Ohio.
J. B. Smallwood, Baltimore, Md.
J. J. Griffin, Philadelphia, Pa.
J. H. Phillips, Cincinnati, Ohio.
J. L. Kelley, Middletown, Ohio.
H. Ranshaw, Cincinnati, Ohio.
T. H. Birch, Cincinnati, Ohio.
W. H. Harris, Athens, Ohio.
G. S. Harris, Mansfield, Ohio.
Isaac McNary, Coshocton, Ohio.
J. W. Dunbar, New Albany, Ind.
T. L. Parkinson, Centralia, Ill.
J. H. Decker, Hannibal, Mo.
E. A. Potter, Ashland, Ohio.
J. Salter, Covington, Ky.
E. M. Starr, Richmond, Ind.
L. K. Schofield, Fort Scott, Kansas.
W. C. Harthan, Selma, Ala.
J. H. Woodmansee, Danville, Ill.
D. R. Russell, St. Louis, Mo.
J. A. Harris, Philadelphia, Pa.
W. T. Bowers, Hillsboro, Ohio.
Eugene Printz, Zanesville, Ohio.
E. McMillin, Ironton, O.
R. C. Johnston, Lawrence, Kan.
C. M. Converse, Delaware, O.
J. Sumner, Des Moines, Iowa.
Jos. Light, Dayton, Ohio.
R. C. Humphrey, Ashtabula, Ohio.

J. J. Howden, Muskegon, Mich. W. Gardner, Pittsburgh, Pa.
W. H. McDonald, Albany, N. Y. A. S. Bushnell, Springfield, Ohio.
T. W. Ellerbeck, Salt Lake City. R. A. Ditmar, Troy, Ohio.
E. B. Philipp, Findlay, Ohio. Henry Felt, Cincinnati, Ohio.
W. S. Howell, Cincinnati, Ohio. J. Brashear, Cincinnati, Ohio.
W. P. Rodgers, St. Louis, Mo.

The applications were referred to a committee consisting of Messrs. Lansden, Burns, and Cosgrove. The committee subsequently reported favorably upon all the applications. On motion, the report of the committee was accepted, and the Secretary was instructed to cast the ballot of the Association for the nominees. This being done, the gentlemen were declared duly elected to membership, and those who were present were introduced to the Association by the President.

[To be continued.]

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A Gas Light Company Comes Out Ahead in a Court.—Mr. George H. Tayler, Secretary and Treasurer of the Warren (Ohio) Gas Light Company, sends us the following. The experience of his company in the matter of legal trouble, is somewhat unique; it almost goes without saying that the average juryman can never be made to understand that a gas manufacturing concern has any right which the law is bound to respect. Be this last statement as it may, the Warren folks certainly have managed to come out ahead. This is what Secretary Tayler says:

"Some eighteen months ago the Pittsburgh, Cleveland and Toledo Railroad Company located the line of their road through the grounds of the Warren Gas Light Company, taking from the south part, a strip about 73 feet in width. Last month, in Probate Court, the gas light company contested the right of the railroad company to appropriate. The grounds advanced by the contestants were that the gas light company was a public institution; that it needed a new holder and purifying house; and, with this land taken from it, would have no suitable place to erect these necessary structures. The contestants also claimed that the railroad company made application for more land than was needed; holding that 64 feet would be amply sufficient for the purpose of the road.

"A suit for damages being brought, on April 24, 1883, a jury was impaneled, and the case advanced to trial. The result being that the gas light company was given the privilege to lay and maintain its mains through the railroad company's land to Main street—thus affording, with the adjoining land, already owned by the gas company, ample room for the needed extensions. In addition to this the railroad people pay to the gas company $2,500 in cash."

The Holders of the New Cincinnati (Ohio) Works to be Built by Stacey & Co.—The Stacey Manufacturing Company, of Cincinnati, Ohio, have secured the contract for building the holders at the new works of the Cincinnati Gas Light Company, "East End Station." The holders are to be telescopic, two in number, the dimensions of which are to be 124 × 60, with 12 wrought iron columns to each. The cubic capacity of each holder is rated at 700,000 feet.

The Brazil & Chicago Coal Company Prefers the Bray Lantern to the Electric Light.—The action of the Brazil & Chicago Coal Company of Chicago, Ills., in lighting their docks with gas may well be considered a matter of general interest to the gas fraternity of the country. The docks are situated on the north side of the Chicago River, and are east of Rush street, they have a frontage of 600 feet and a depth of 400 feet, with a water depth of from 16 to 18 feet. The magnitude of the concern can be readily conceived when it is stated that the largest lake steamers are "coaled" in three or four hours, and that 600 tons of coal can be handled with ease in a day. Of course, this busy scene must have light at all times, the vessel interests requiring that the greater part of the work be done at night, and the difficulty of properly lighting the place will be fully appreciated.

The ground, as well as every obstacle, being black with coal-dust, reflects no kindly light to relieve the blacker shadows thrown by the electric glare. Oil's sickly glimmer sinks into the black surfaces and is lost. For years every known contrivance of oil lighting was tried, and the dangers of constant explosions braved, and the expense of breakage and repairs, and labor to keep the many lamps in order endured only for lack of something better. Then electric light was vigorously urged, but rejected. The multitude of obstructions to the direct light producing such a labyrinth of black shadows as to retard the free movement of men and teams, also the dazzling effect of the light upon the eye, producing temporary blinding, and making work on platform and gang planks both difficult and dangerous, it was therefore finally concluded that work under the electric light could not be carried on to advantage. And as the cost proved excessive, with no facilities of reducing it temporarily when not needed, it was not adopted. However, Mr. C. B. Niblock, the owner of the docks, had made up his mind to have light, and of the right kind, and he is now happy in the accomplishment of his design. His docks now bask at midnight in the effulgent rays of three local suns; the mighty propeller and the restless tugs come and depart in peace, with no fear of collision, at all hours of the night. Trains of men and teams cross and pass each other rapidly and without confusion. A flood of soft light pervades every nook and corner. Work under the lowest platform proceeds as regularly throughout the night as during the day, and the most remote parts of the yard are traveled with safety. Nor is the workman dazzled and blinded and put in peril after every casual glance at the light, but his narrow plank and loaded barrow always look the same to him. Mr. Niblock's purchase of three Bray lanterns has brought about this happy result. These lanterns are constructed and imported exclusively by the Goodwin Gas Stove & Meter Company, and their Chicago manager has just placed in the center of the dock a 200-candle power lantern. Another of 100-candle power is placed 200 feet off, and another of 80-candle power about 100 feet in the opposite direction. The two first-mentioned are raised 20 feet from the ground, and light all the elevations and intervening open spaces; the latter is placed 10 feet from the ground and under the highest platform, and lights all the space under cover. These lanterns consume the city gas as follows: With 16-candle gas, the 200-candle power lantern consumes 55 cubic feet per hour. The 100-candle power lantern consumes 30 cubic feet per hour. The 80-candle power lantern consumes 24 cubic feet per hour. Total consumption per hour, 109 cubic feet, at $2.25 per 1,000 cubic feet, 24 25-100 cents per hour. There is no end to the economy that may be practiced here by "turning down" the gas at any moment when the full volume of light is not needed.

"The man who attends to the lamps" has now more profitable occupation. The bill for new lamp-chimneys is now a thing of the past. The dangerous oil-barrel is no longer a weight of anxiety on the owner's heart.

In fact, when the lights were turned on for the first time, it was seen that comfort and satisfaction had for once been met by economy more than half way. A liberal collation assisted the lights in keeping up the interest to a late hour, when, after the proper speeches, the guests finally departed, amidst a storm of steam whistles, fully satisfied that the prayer of Ajax had at last been properly answered.

The Providence (R. I.) Gas Company Visited by Thieves.—A very daring and successful robbery was perpetrated in the office of the Providence Gas Company, between the hours of 12 and 2 o'clock, on the afternoon of Wednesday, May 2.

At 12:30 o'clock the paymaster, Mr. Alfred Luther, went to dinner, leaving in the safe at one side of the office, two boxes, one of pasteboard and one of tin, the two containing about $4,000 in pay envelopes, which sum was intended for the payment of the employees. When the paymaster left the office, the head clerk was busily engaged at the counter, at the further end of the office, near the entrance, and was standing the greater part of the time, with his back towards the safe, which was 30 feet away. At 1:30 o'clock the paymaster returned and, upon going to the safe, which was then open, discovered that both boxes were missing. At first he thought that some of the clerks were playing a joke upon him, but it did not take long to find out that the money had been stolen by some daring thief. Further search resulted in the finding in a side entry, near the entrance to the office, the two missing boxes, entirely empty, except that in one of them was a solitary pay envelope. The thief must have stealthily crept through two of the back rooms and approached the safe from a doorway near it, then retraced his steps, passed through the side entry mentioned above, and gone out into the yard by the entry door, springing the "catch" lock on the door as he passed out. The police are now at work on the case, but there seems to be no clue, as yet, to the bold and shrewd thief.

Paymaster Luther will most likely keep a sharper eye on the money-bags hereafter.

It Could Easily have been Worse.—The conducter of a local freight train, which left the depot of the Hudson River Railway at 7:30 P. M., on the evening of Friday, May 4, undertook to make a "flying switch" at Yonkers—that is, tried to run a rear car on to a side-track, and was partially successful; but, a moment later, while the forward part of the train was backing up too quickly, it collided with the detached portion, and four cars were thrown from the track. One of them crashed into the yard of the gas works which stands close to the track; and as luck would have it, stopped just in the nick of time and place. Had the car gone a foot further disastrous consequences were sure to have resulted.

Solving the Problem.—The New Orleans *Picayune* has made the discovery that the reason why some of the street lamps in that city burn all night is because the light is so small that it is afraid to go out alone in the dark. Right here we might make mere mention of the fact that the city of New Orleans only owes the gas company, for public lighting, the bagatelle

of about $200,000; and if we do not mistake the lights all went out rather suddenly some time ago, and failed to "show up" until the city fathers partially came to their senses. We wonder if the *Picayune* folks pay their gas bills promptly.

Electric Lighting in Denver, Col.—It is stated that, in proportion to population and territory, Denver can boast of a greater number of arc lights than any other city in the United States; and, by the way, Denver must in time be a well-lighted place, judging from the number of parties who are anxious to get established there in the business of supplying artificial light. What with the old gas company and the Brush electric company, the new gas company and the Colorado Edison Electric Light Company, we must condole with the inhabitants of the place. The last-named corporation was organized about six weeks ago, and starts in with a capital of $150,000. The officers are as follows: Wm. Orton (son of Wm. Orton, late President of the Western Union Telegraph Company), President; Wm. Moore, Vice-President; W. D. Todd, Secretary; Wm. M. Cox, Treasurer; and S. T. Armstrong, General Superintendent.

Street Lighting at Evansville, Ind.—Evansville, Ind., is at present lighted, as to its streets, by 818 street lamps, and these lamps are scattered over a large area, owing to the somewhat irregular manner in which Evansville has spread. The electric light folks are trying hard to get a foothold, and, as usual, make great promises. They claim that one of the arc lights will give as good if not a better service than six of the gas lights now in use, etc., etc. The Evansville *Daily News* does not seem to be very enthusiastic on the project, as witness the following:

"In order to illuminate the city by electricity, as originally proposed, it will require a fraction over 136 lights, at $312.50 each per year, or $42,500, to substitute that light for gas, which costs now $16,359.96 per year, or an increase of $26,140.04 yearly to light the same area. That it is the intention of the company to ask for another change in its contract with the city, so that it may be released from the tower clause, as we said before the election it would, is evident from the tone of its organs, which virtually admit that the tower system will not do.

"This sum is a little in excess of the minimum figures given by the *News* before the election, which were $39,000. But the present calculation is but a conjecture, based on the way the lights are now placed at street intersections; and if we will assume that the company will propose to put up but two-thirds of the number named, or 90 lights, the cost will be $28,437.50, which seems to us as low as anything like the present area can be lighted with the electric light, or nearly double what it costs with gas. As it is evident that some such change is contemplated, we suggest to the tax league, if it is still in existence, that the payment of the money to the company, or any other money, unless it be a sum that is less than is now paid the gas company for lighting the same area, be enjoined as contrary to the law, which forbids the incurring of any more indebtedness, the city being already in debt beyond its constitutional limit.

"We freely admit that the reference to the tax league is sarcastic, now that so many of its members are stockholders or advocates of the substitution of the electric light for gas; but we trust that someone else, who is sincere in his objection to the increase of expenses, will take the hint and enjoin the payment of the first bill of the electric light company that shall be ordered paid by the council, unless it lights the same area now lighted by gas at a less expense."

New Manger for the Vera Cruz (Mexico) Gas Works.—Mr. James Merriman, of Pictou, Nova Scotia, is on his way to Vera Cruz to take charge of the works at that place. These works are owned and controlled by Juan A. Murphy, who was, some years ago, in charge of the plant of the Havana (Cuba) Gas Light Company. Mr. Merriman has had considerable experience in gas matters in South America, having built works in Valparaiso, Copiapo, and Iquique. He is the right man in the right place.

The Sensible Thing.—Mr. Butterworth, of the Rockford Gas Light Company, of Rockford, Ill., has gotten up for free distribution among his consumers a very neat little pamphlet, setting forth the advantages of gas for cooking. Now that the summer season is close at hand, it behooves the prudent and progressive manager to place before the eyes of his customers a simple and plain statement of facts showing what may be accomplished in the way of cooking by gas. Philanthropy need not enter into the thing at all—show the consumer that he can benefit himself by using a gas range or cooking stove during the summer season, and that is all there is to be done in the premises. Get the stoves in use, and up goes the send-out. The little common-sense pamphlet of Mr. Butterworth is so nicely put together that we here reprint it:

"*Advantages of Gas for Cooking.*—The convenience and comfort of cooking by gas, especially during the summer months, when a fire is not otherwise required, can only be thoroughly appreciated by those who have had experience in its extremely useful application for that purpose. One of the numerous advantages of the gas stoves, is the saving of heat, as the stoves can be used immediately after they are lighted, and turned off the minute they are done with, instead of keeping a fire burning all, or a large part, of the day. Another is the saving of labor, as there are no ashes to be removed from the premises, or scattered over the house; no coal or wood to handle, or time wasted in waiting for the fire to burn. There is no necessity for building the same sized fire for boiling a quart of water, that you would to cook a dinner, as you can regulate the supply of gas at will.

"The objection so commonly heard against cooking with gas, that it taints the food, and consequently that the food cooked in this way is prejudicial to the health of those who eat it, is entirely without foundation. As a matter of fact, the whole of the food at a London hospital is cooked by gas, not only for the patients, but for the staff of surgeons and attendants as well; on the contrary, it is healthful, through the absence of waste of heat, soot, smoke and dust. The question is asked very often, what does it cost to cook by gas, as compared with wood and coal? and we do not hesitate in affirming that, gas as a fuel, when properly regulated, and not used wastefully, is cheaper than either coal or wood.

"We would be pleased to have you call and inspect our large stock of gas stoves and see the working of them. Yours truly,

Rockford Gas Light and Coke Co."

Annual Report of the Jamaica Plain (Mass.) Gas Light Company.—The Twenty-eighth Annual Report of this company, embracing an account of working operations of the fiscal year ending March 31, 1883, has just been made public From it we learn that the total receipts from all sources for the period stated amounted to $54,784.38, and the total payments, excluding two semi-annual dividends of 4 per cent. each, amounted to $35,369.17. After paying the two dividends the company carried to surplus the sum of $3,415.21, making the sum total to be charged to surplus account $32,077.75. Among the items charged to payments we find that the Jamaica Plain Company has paid into the town treasury for taxes (State and city) and assessments no less a sum than $4,421.19. We should imagine that the town of Jamaica Plain would be inclined to look upon its gas company as a solid, substantial and solvent citizen.

If that "interesting party" generally designated under the title of "Chronic Growler," would only examine the tax-rolls of his "native heather" before indulging in one of his "spasms," we would possibly hear less talk about "soulless corporations never giving anything to the municipality in return for the valuable franchises which have been so munificently bestowed"—and "bestowed" for whose benefit principally? The coroporation or manufacturing concern which has been given legal existence? Indeed, no; but rather that the people of the locality, wherever it may be situated, may be better served in some particular direction.

The report under consideration further states:

"Our new works, which were in process of erection at the date of the last annual report, have been completed, and we have as good and complete a set of works as can be found in New England.

"We have a new retort-house, with six benches of sixes, of large capacity, and the most approved settings; a new purifying-house, with four large purifiers; a new and improved condenser, exhauster, governor, and station meter—all of sufficient capacity to meet the probable wants of the company for many years to come.

"These works have cost the company $43,257.37. It was not deemed best by the directors to increase the capital stock to meet these requirements, and it will be seen from the statement of liabilities and assets, that the former exceed the latter only in the sum of $11,179.62. With as good results for the next two or three years as we have had in the past, it will be liquidated; and we may congratulate ourselves that we have been able to make these great and important improvements, and create so small a debt, and at the same time keep our capital where it has been for several years, at $200,000, every dollar of which represents cash paid into the treasury and expended upon our works."

The experience of the Jamaica Plain Company, in the matter of reduction in price as affecting the send-out, will be found elsewhere in this number of the Journal.

Found Dead in His Room.—The New York *Times*, of May 5, gives the following account of the death of Emanuel Miller. It was at first supposed that the cause of death was from inhaling illuminating gas; but subsequent investigation appeared to show that such was not the case:

"Emanuel Miller, 64 years of age, book-keeper for George C. Rand, a coffee merchant of No. 107 Wall street, was found dead yesterday in his room at No 313 West Twenty-second street. The door was forced by an officer of the Sixteenth Precinct, and because the room was full of gas it was believed that he had accidentally or intentionally turned the gas on. It is probable, however, that Mr. Miller died of appoplexy while dressing. He had entangled one of his feet in the legs of an arm-chair and lay prone, holding in

one hand an article of underclothing and the other hand grasped the leg of a chair. His face was black, and there was not enough gas in the room to kill a person, and no attempt had been made to stop up cracks and openings. He was a widower, and two sons, who live in Philadelphia, were informed of his death."

THE METER EXPERT ARRIVES IN NEW YORK CITY.—Mr. Wilsdon found the weather too warm for him in Philadelphia, and we are of the opinion that he will experience a marked rise in the thermometer in New York City, where at the time of the present writing, he has located. He is looking up the proprietors of hotels, with his "little meter," and circulating stories about the number of rebates which he has enabled the bonifaces of other cities visited by him to obtain from the gas companies on account of "fast" registering meters.

[Since the above was written the "expert," with his man Friday, paid the JOURNAL office a visit. His first demand upon entering was, "To know who the editor was? He had been ridiculed in the last number of the JOURNAL; and wanted to know, you know, etc." After a while, he concluded that the Philadelphia Gas Trust was at the bottom of the whole trouble—and he decided there and then that the Gas Trust would have to suffer. He announced his intention of going right back to Philadelphia, provided he could "make things fit"—this was on the afternoon of the 10th. We have his assurance that we will hear from him again, and that right quick. We promised a rise in the thermometer in New York, but the mercury appears to have gone up with a rush.]

DISCOVERY OF ANOTHER NATURAL GAS WELL.—At Greensburg, Pa., on May 5, in the vicinity of Lyon's Run, an immense vein of natural gas was struck in the course of sinking a boring for petroleum. It is a regular roarer, and the noise made by the escaping gas is described as tremendous.

It is estimated 6,000,000 cubic feet are daily wasted. The well is conceded by all who have seen it to exceed in power the old Murraysville well and the new wells of Messrs. Boulton & Doubleday and Pugh & Emerson's, all three put together. The new well is 2½ miles nearer Pittsburgh than the Murraysville well. Messrs. Bolton & Doubleday have bought an acre close by the new well, and will put down another well in the hope of securing some of the gas of Messrs. Brunot and Haymaker's well. Twenty thousand dollars has been offered for the new well.

TROUBLE IN THE LOUISVILLE GAS LIGHT COMPANY'S BOARD OF DIRECTORS.—On Friday, May 4, Judge Edwards rendered a decision in the controversy over the Directory of the the Louisville G s Company. In the first place he holds that the election of Silas F. Miller and C. T. Vennigerholtz to the directory by the General Council was valid. Mr. C. P. Moorman, who was proceeded against as a claimant to a seat in the directory, made answer disclaiming all rights thereto. This leaves a seat for which there is no contest, and Judge Edwards gives the title of it to Mi'ler over Vennigerholtz, by virtue of his being first to take action. By this decision Mr. Vennigerholtz is left to contest with Mr. Isaac Wolf for the remaining seat. The Judge holds that there is a remedy at law for Mr. Vennigerholtz, and transfers the action against Wolf to the Common Pleas Court to have the legal rights of the parties determined.

NOT QUITE SATISFIED WITH GASOLINE.—The editor of the Lancaster (Pa.) *New Era* is not satisfied with gasoline for street lamps. He says:

"The lamp committee, as will be seen by our advertising columns, invite proposals for lighting this city for the year commencing July 1, next. They leave the contract open to the electric light, gas and coal oil competition, and we trust the electric and gas light interests will present their claims in so strong a light as to leave the gasoline flicker go out in total darkness." There is little doubt but that Mr. Smedberg will see to it tha. the gas interest will be properly presented.

BALTIMORE'S ELECTRIC LIGHTS.—There are 225 "arc" lights in the streets of Baltimore, Md. The price paid per lamp per night is 70 cents; the lamps burn all night. Since the reduction in price of gas to $1.00 per thousand, many storekeepers, who had hitherto been using the "arc" light, have discontinued its employment. With gas at this figure, it will even trouble kerosene oil to "keep the pace."

KILLED BY INHALING GAS AT BALTIMORE, MD.—A fatal case of suffocation, caused by the inhalation of gas, occurred at Baltimore, Md., on the morning of May 4. E. O. Koller, of Glen Rock, Pa., was the unfortunate individual. He retired to his room, in a hotel near the Calvert railway station, at about 3 A. M., giving orders to be awakened three hours later. He was not called until 7 o'clock on the evening of the same day, when he was discovered lying dead in his bed. The room was full of gas, and it is supposed that he blew out the gas previous to retiring. We are informed that the hotel, in which the death occurred, is supplied with gas from the mains of the Consolidated Gas Light Company. This company manufactures both water and coal gas. What proportion of each gas exists in the mixture supplied to consumers is not known to us; but we believe that the water gas element largely predominates.

PERSONAL.—Messrs. Backus and Berdan, of the executive committee of the Toledo (Ohio) Gas Light Company, accompanied by Superintendent Faben, visited New York City, recently. The object of the visit was to acquire information concerning machinery which will be required for the important additions that the company proposes to make to its existing gas plant. The improvements are to be finished in time for the winter's work.

Mr. W. J. Fay, Superintendent of the Denver (Col.) Gas Light Company, also arrived in this city, on May 4. Mr. Fav reports a rapidly enlarging business, and expresses no fear as to the results of the expected competition with the proposed water gas establishment in his city.

FIRE AT THE STANDARD OIL WORKS.—One of the oil tanks at the Communipaw (N. J.) works of the Standard Oil Company was struck by lightning, during the prevalence of a severe thunderstorm, on the morning of Thursday, May 10. The fire communicated rapidly to the tanks adjoining, and a disastrous conflagration resulted. Six employees were killed; the loss is estimated at upwards of a half a million of dollars.

GOING TO SUE THE WASHINGTON (D. C.) GAS LIGHT COMPANY.—It is reported that the authorities are about to bring suit against the Washington Gas Light Company, on the ground that the illuminating power of the gas supplied is not up to the standard required by the statutes of the District of Columbia. The said statute provides that the gas shall be equal to 16 candles, and shall not contain more than 20 grains of sulphur in 100 cubic feet, nor more than 5 grains of ammonia, in any form, in 100 cubic feet. The penalty is $100 for each case of violation, unless the occurrence is proved to have been unavoidable. The city Solons claim that gas of lower illuminating power than is required by the regulation, was sent out on five different dates in January; and that sulphur was in excess on two occasions in the same month. The report of Inspector Ford, for March, states that the average photogenic power of the gas supplied by the Washington Gas Light Company was found equal to 18.02 standard candles; but we don't suppose that goes for anything—hardly any grounds for a suit on the March showing. Pretty certain it is, though, that if the United States Gas and Fuel Company has obtained a charter last winter, the law would not be invoked now. A "sore head" is a bitter complaint.

SALE OF A GAS WORKS.—The Nebraska City (Neb.) Gas Works were sold at public sale, on May 3, under foreclosure proceedings, instituted by the mortgage bondholders. Parties, representing the interest of the bondholders, bought in the works, in order to acquire title; and subsequently resold the property to Messrs. E. McMillin and H. B. Wilson, of Ironton, Ohio.

SEVERE ILLNESS OF MR. W. H. PRICE, OF CLEVELAND, OHIO.—It will be with sincere sorrow that the fraternity will learn of the severe illness of Mr. W. H. Price, of Cleveland, Ohio. This estimable gentleman was stricken down with disease some ten weeks ago, and, at the present time, is very low. Some hope is entertained of his ultimate recovery; and it is the heartfelt wish of all who know him that this hope may be borne out by his speedy return to health and usefulness.

THE "STANDARD" WASHER-SCRUBBER AT CINCINNATI, OHIO.—The Cincinnati Gas Light Company has decided to erect two "Standard" Washer-Scrubbers at the new East End station; the capacity of each scrubber will be 1,500,000 cubic feet.

The Market for Gas Securities.

The city market for gas securities has been dull and almost featureless. The tendency of prices appears to have been in the direction of lower figures, and this statement will hold good for every section of the country. In city shares, we quote Manhattan, at 233 to 236; Metropolitan, at 185 to 190, ex-dividend; Mutual, 113 to 116; Harlem, steady, at last quotation. We note a sale at auction, on May 9, of 300 shares Mutual, at 115½. At the annual meeting of the Harlem company the old board of officers was re-elected; the annual report to the stockholders is very flattering.

In out-of-town shares, Consolidated, of Baltimore, is lower, sales having been made at as low a figure as 39⅛; we quote bonds of same company at 106¾ to 107. Hartford gas is strong at 118 to 122. Laclede gas, St. Louis, Mo., is a shade stronger, and St. Louis gas is weaker; this stock is now selling ex-dividend, and 250 to 255 would be a fair quotation. Washington (D. C.) gas also sells ex-dividend and privileges, and 182½ is bid. San Francisco gas is steady, we note sales of 535 shares at 57½ to 59¼; Central gas, of same place, is also higher, 120 shares bringing 45; Oakland gas (Cal.) is weaker. During the month of April the following dividends were paid on gas shares held principally in San Francisco:

San Francisco Gas Light Company,				$1.00 per share..	$100,000
Capital	"	"	"	$1.25 per share..	12,500
Oakland	"	"	"	20 cts per share..	6,000

For further matters of interest to gas shareholders see "Item columns."

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks (with W. B. Scott & co.,)

34 Pine Street, New York City.

May 16, 1883.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Central	$466,000	50	85	90
Harlem	1,800,000	50	97	100
" Bonds	170,000		—	—
Manhattan	4,000,000	50	233	236
Metropolitan	2,500,000	100	185	190x
" Bonds	658,000	—	105	110
Mutual	3,500,000	100	113	116
" Bonds	1,500,000	1000	103	105
Municipal	3,000,000	100	180	182
" Bonds	750,000		107	110
New York	4,000,000	100	120	123
Northern	125,000	50	—	95
" Scrip	108,000			
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	110	112x
Citizens	1,200,000	20	75	80
" S. F. Bonds	320,000	1000	105	107
Fulton Municipal	1,500,000	100	70	80

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THE DOUGLAS
Tar Burner and Tar Valve.

Simple in construction. Will not stop up, and gives the most perfect combustion, the tar supply being gauged exactly to the work required.

J. Fullager, Superintendent Cincinnati Gas Works, says of it: "I deem your Burner perfection for the economical consumption of tar for heating benches."

Correspondence solicited.

S. H. DOUGLAS,
GAS COMPANY, ANN ARBOR, MICH.

WANTED.

A SUPERINTENDENT FOR SMALL GAS WORKS

NEAR BOSTON.

Address, giving references and qualifications, with salary expected, **P. O. Box 5104, Boston, Mass.**

CHEESMAN'S
Solid End Gas Purifying Trays,

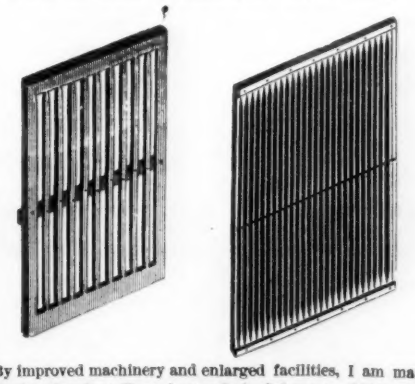
WITH CONICAL AND DIAMOND SHAPED BARS.

Patented Oct. 21, 1862, and June 10, 1873.

HARRY W. GLOVER,

Successor and Sole Manufacturer,

151 & 153 Avenue C, N. Y. City.



By improved machinery and enlarged facilities, I am manufacturing the above Trays in any desired shape or thickness, or of any kind of wood, with width of bars and openings to suit the wishes of my customers. The most durable Tray in use. Have lasted 10 years in the Metropolitan (N. Y. city), New York (N.Y. city), Williamsburgh City (N. Y.), and many other gas works.

FOR SALE.

Gardner Bros. Gas Retort and Fire Brick Works.

Established in 1864. Situated at Lockport Station, on the P. R. R., 60 miles from Pittsburgh, Pa. The Works consist of complete plant for manufacturing Clay Gas Retorts, Settings, Blocks, Tiles, and Fire Brick. Capacity, about 100 retorts, with necessary settings, and 100,000 fire brick per month. Clay and coal mined by ourselves within short distance of Works and hauled in wagons. Over three acres of land, with all necessary buildings, a number of tenements and town lots. The P. R. R. has side track alongside our kilns. Good trade established. Our good will and influence to go with sale. Statement of business done will be shown to responsible parties desiring to purchase. Any further information desired will be cheerfully given by Gardner Bros., Lockport, Pa.

ALSO,

Gardner Bros. "Standard Savage" Fire Brick Works.

Established in 1873. Situated at Ellerslie Station, Md., on Balt. & O. R. R.; also on Bedford Branch of P. R. R. Has convenient shipping arrangements on both roads. Works consist of two independent plants of machinery, so constructed and arranged that they can be run separately or together. One of the buildings entirely new, erected last year. Capacity of Works, over 14,000 bricks per day. Mount Savage Clay in abundance, mined on royalty, and delivered direct into Works by gravity. Inclined plane and tramroad, large portion of which was laid with new T-rail last year. New artesian well, capacity over 35 barrels per hour; also mountain stream delivering water by gravity into tanks at Works. Seven acres of land, with 9 good tenements. Everything in first-class order for manufacturing and shipping brick direct from kilns into cars. Good and growing trade established. Brick unquestionably as good as the best made of Mount Savage Clay. Statements of business done will be shown to responsible parties desirous of purchasing. Our good will and influence to go with sale. Any further information desired will be cheerfully given by Gardner Bros., Lockport, Pa.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial*. No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON, Supt., 42 PINE ST., N. Y.

A TABLE

GIVING THE MONTHLY RANGE OF PRICES DURING 1882 OF BANK STOCKS, INSURANCE, GAS, CITY RAILROAD, AND TRUST COMPANY STOCKS OF NEW YORK AND BROOKLYN. To be had on application.

J. P. WINTRINGHAM, 36 Pine St., N. Y. City.

FOR SALE.

SECOND-HAND

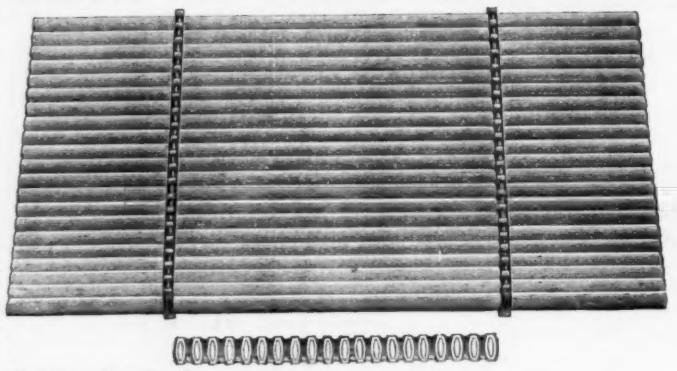
TEN INCH GAS WORKS,

Consisting of Boiler, Engine, Rotary Exhauster, Twelve-foot Purifiers, Condenser, Scrubber, Seven-foot Station Meter, with all necessary By-Passes, Connections, and Gauges. Works been in use between five and six years. Drawings of same will be furnished to parties desirous of purchasing.

Address **P. O. Box 373,**

573-6t PITTSBURGH, PA.

CHURCH'S REVERSIBLE SCREEN FOR GAS PURIFIERS



PATENTED JULY 9, 1878.

Very Durable

Easily Repaired.

Oval Slats, with Malleable Iron Cross Bars.

Apply to

JOHN CABOT,

LAWRENCE, MASS.

In Use at the Following Gas Works:

Lawrence, Mass.	Gloucester, Mass.	Sedalia, Mo.	St. John, N. B.	New Haven, Conn.
Roxbury, "	Taunton, "	Lawrence, Kan.	Portland, Maine.	Birmingham, Conn.
Cambridge, "	Salem, "	Reno, Nev.	Manchester, N. H.	Detroit, Mich.
Waltham, "	Clinton, "	Jersey City, N. J.	Nashua, N. H.	Lansing, Mich.
Lowell, "	Dorchester "	Passaic, N. J.	Burlington, Vt.	Hamilton, Ohio.
Charlestown "	Selma, Ala.	Jacksonsonville, Fla.	Newport, R. I.	Cleveland, Ohio.
Springfield, "	Charleston, S. C.	Richmond, Ind.	Pawtucket, R. I.	Gallipolis, Ohio.
Boston, "	Charlestown, W. Va.	Denver, Col.	Providence, R. I.	Cincinnati, Ohio.

"Their Merit has Established their Great Popularity."

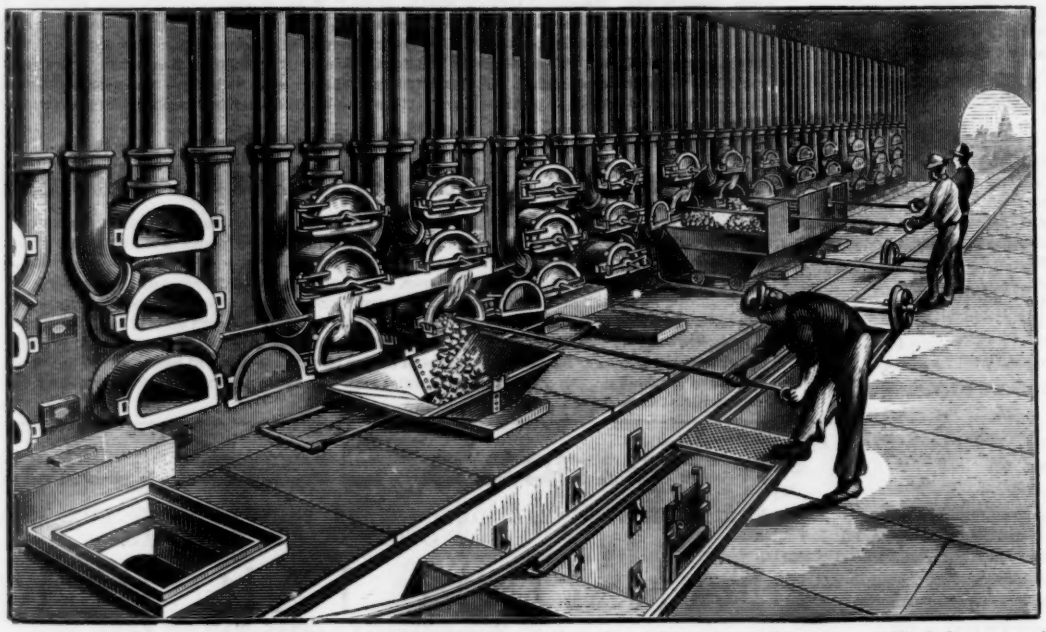
GAS RETORT STOVE COMPANY.

The Retort Gas Stoves still continue to maintain the lead. The use of Gas Cooking Stoves becomes more general each year, and those gas companies and house furnishing dealers who keep a stock of Retort Gas Stoves are sure to find a ready sale for them. The Retort Gas Stoves are sold on their merits, and satisfaction is guaranteed. We make a large variety of sizes and patterns, and the prices are 20 per cent. cheaper than others offer.

JAMES C. LESTER, Agent, P. O. Box 1256, PROVIDENCE, R. I.

Chas. F. Dieterich's Regenerator Furnace.

CAN BE ADAPTED TO ANY BENCH WITHOUT DISTURBING THE ORDINARY SETTINGS.



These Furnaces have been in operation at the works of the People's Gas Company, Baltimore, since June, 1878. A bench of sixes, with retorts 20 in. by 12 in. by 8 ft. 6 in. will burn off 1,350 pounds of coal in 3 hours. Twenty-five per cent. of the coke is sufficient to thoroughly burn off the charges.

State, city, and factory rights granted on reasonable terms. For full particulars apply to either

CHAS. F. DIETERICH, Engineer P. O. Box 512, BALTIMORE, MD.

WM. FARMER, 111 Broadway, N. Y. **F. L. HAGADORN**, 162 Beach St., Chicago, or **HENRY J. DAVISON**, 231 Broadway, N. Y

Awarded the Semi-Centennial Gold Medal by the Am. Inst., 1881. Awarded the First Premiums at St. Louis, '81 & '82.

AMERICAN METER CO.,

SOLE MANUFACTURERS OF THE

"ECONOMY" GAS STOVES

In presenting our "Economy" Gas Cooking Stoves for the season of 1883, we would state that we are most firmly convinced of their superior efficiency, durability, and economical use of gas for culinary purposes. To promptly meet the demand we anticipate for these Stoves, we have arranged to keep large and varied stocks at our manufactories and agencies.

These Stoves have been awarded the *Semi-Centennial Gold Medal* and *Medal of Superiority* at the Exhibitions of the American Institute, 1881 and 1882, the *First Premiums* at the St. Louis Fairs, 1881 and 1882, and the *Gold Medal* of the Union Universelle de l'Art Culinaire. AMERICAN METER COMPANY.

"ECONOMY" GAS STOVES.

All sizes of our "Economy" Range, from "6A" upward,

ARE FITTED WITH THE

NEW AND IMPROVED ROASTING OVEN DOOR

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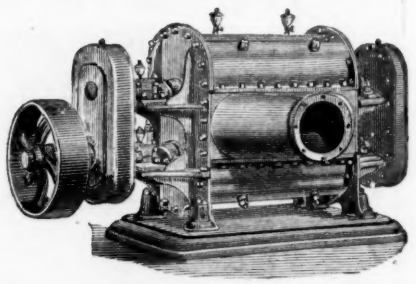

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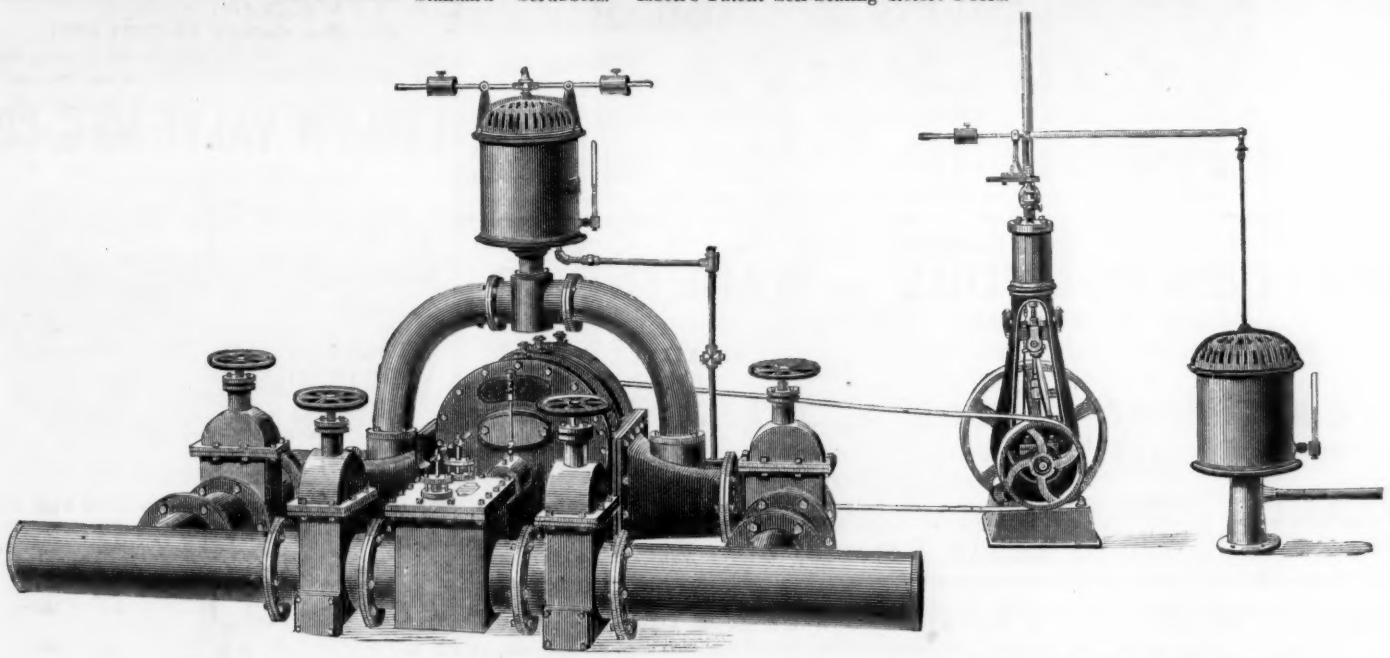

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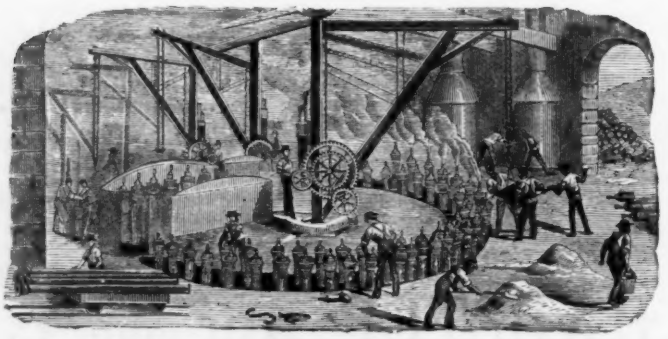

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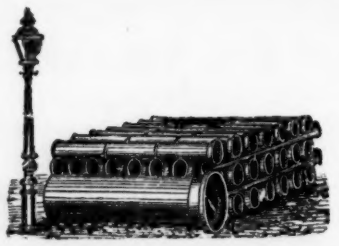

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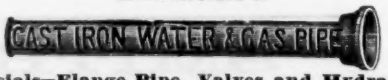

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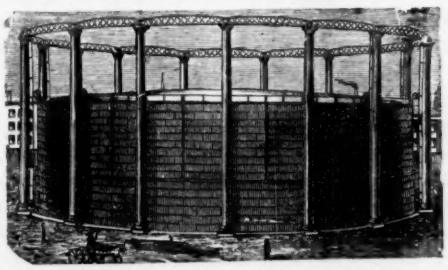

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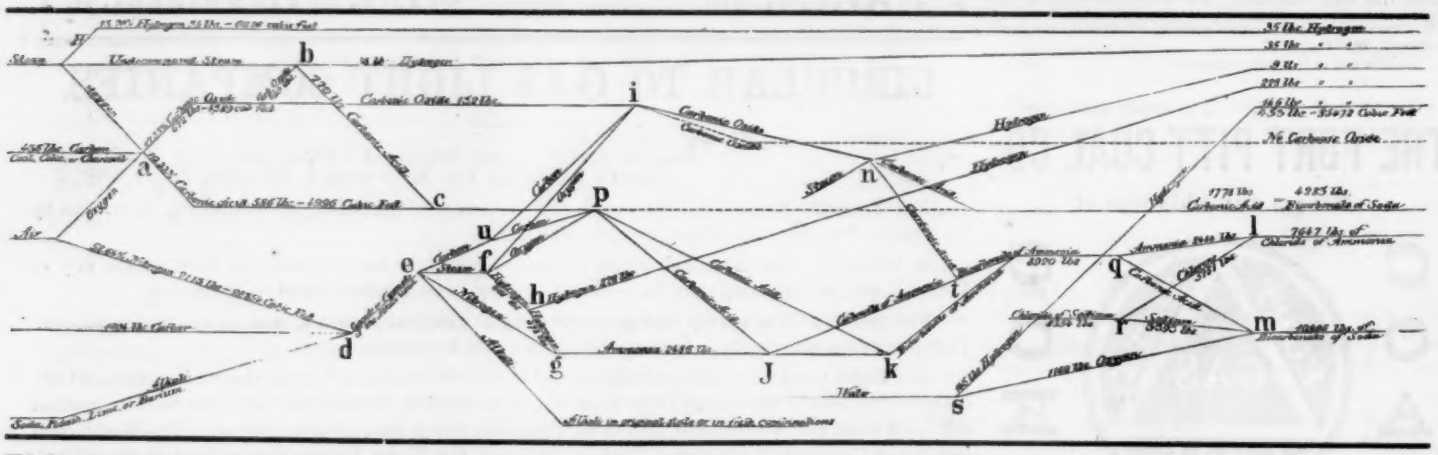

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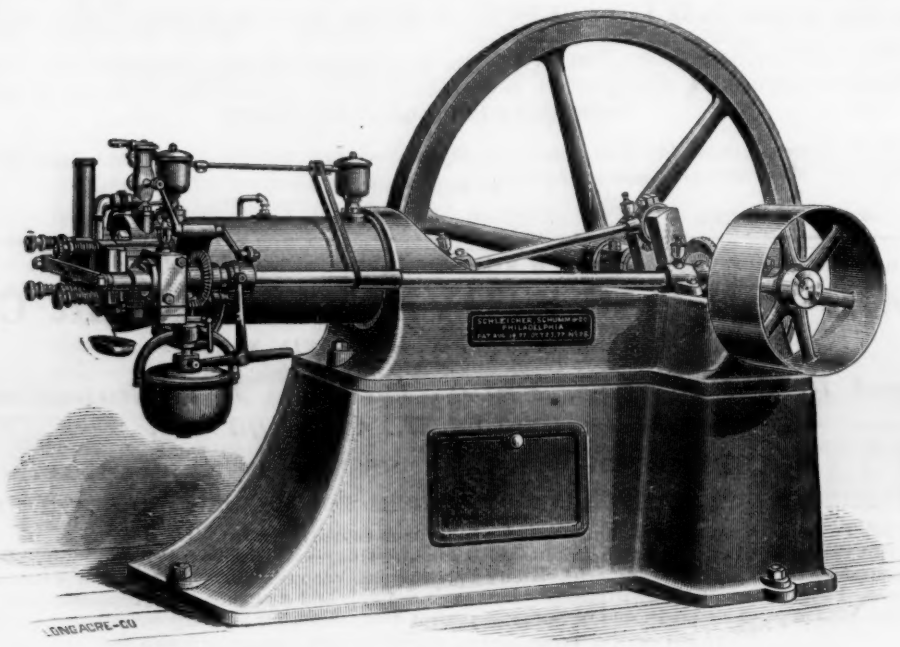

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